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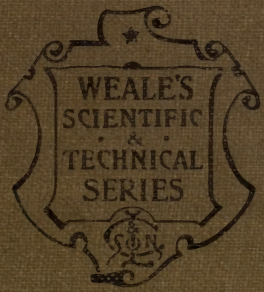
PLASTERING



WILFRED KEMP

THE PRACTICAL PLASTERER

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PRACTICAL PLASTERER

A COMPENDIUM OF

Plain and Ornamental Plaster Work

WITH USEFUL RECIPES AND A GLOSSARY OF TERMS

By WILFRED KEMP, Plasterer

With Fifty-two Illustrations

FOURTH EDITION

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PREFACE.

It is somewhat remarkable that, although most of the useful arts and crafts are fairly well represented in the literature of our own and other languages, the trade of the Plasterer—which is one of the most ancient of callings—has no adequate representation in technical literature. Hence the production of this volume, in which the Author has endeavoured to give a concise and practical *résumé* of the art as now pursued in this country.

The work does not, of course, profess to be a complete or exhaustive treatise, but it is at least an honest attempt to deal on practical lines, within the limits stated, with an ancient and important craft; it embodies a considerable

amount of useful information; and as the first independent work on the subject in our language it may lead the way to further efforts to illustrate and develop the Art of the Plasterer.

The Author would venture, therefore, to solicit from any of his readers practised in the art, who may see their way to offer suggestions for the improvement of the volume, the favour of frank communication with him thereon, addressed to the care of the Publishers, and they may feel assured of his readiness to give all such suggestions the most careful consideration, for the improvement of succeeding editions of the work.

LONDON.

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THE

PRACTICAL PLASTERER.

CHAPTER I.

Introductory.

Our English word "plaster" (anciently spelled "plaister") appears to be derived from the Greek word ἔμπλαστρον, through the Latin and Norman-French, and has conveyed all along the idea of a plastic and adhesive matter, which could be daubed or spread on surfaces, or wrapped around any object.

It would appear that some form of plaster, more or less closely resembling that now in use, was employed from a very early period in the history of architecture.

That active-minded and energetic race, which at an early epoch in the history of humanity occupied the Nile valley — the ancient Egyptians—to whom we owe the origin of so many of our existing arts and crafts, discovered the composition of practicable plaster, and used it freely in the interiors of many of their edifices. Of course, there is not a great deal of it now

visible in anything like perfect condition, except in a few tombs which have not been opened for any great length of time, but explorers have at least discovered amply sufficient specimens to prove that the ancient Egyptians made good plaster and were skilful plasterers.

If we take our Authorised Version of the sacred Scriptures as a correct rendering of the ancient Hebrew text, we conclude that the children of Israel of the time of Moses were acquainted with the use of plaster. This is not surprising if we reflect that they had been, to use a Biblical expression, "Pharaoh's bondmen in Egypt," and the Egyptians, as we have just seen, were adepts at plastering. One text occurs in Leviticus xiv. 42, where, speaking of a house which had become leprous, the law for the leper says, "And they shall take other stones and put them in the place of those stones, and he" (*i.e.* the priest) "shall take mortar, and shall plaister the house." The old-fashioned spelling of "plaster" is of course retained here.

The ancient Greeks were mainly a marble-building people. They had quarries of splendid white marble at Pentelicus, Paros, and elsewhere in Hellas, and used this magnificent material freely, and, indeed, almost exclusively, both for their statuary and their edifices. Hence they had little need of plaster, and did not use it to any great extent.

The next great building people—the Romans—made very considerable use of plaster for

coating internal walls, and excelled in the preparation of it. These walls were afterwards elaborately painted in fresco with grotesques and arabesques, and this kind of work called for a very smooth, hard surface. Excavations at Rome, Pompeii, Herculaneum, and other places in Italy, have revealed sufficient specimens of the ancient Roman plaster to convince us that its quality was most excellent. Analyses of these, and also the statements of the Roman writer Vitruvius, in his Latin treatise on Architecture, which has come down to us, show us that this ancient stucco or plaster was composed of well-burned and slaked lime, a little fine sand, and some finely-ground unburned limestone or white marble dust. These were well gauged together with water, and beaten with sticks until a good workable plaster was produced. Vitruvius, of whom I have spoken, recommends that the fragments of marble be sifted into three degrees of fineness, using the coarser for the early coats and the finest for the finish, after which the surface could be polished with chalk and powdered lime if a greater degree of smoothness should be desired.

During the mediæval period we do not find much plaster work (except external "rough cast" for cottages), with the notable exception of that executed by the Arabs, Saracens, and Moors, of which I shall presently speak.

At that period of the revival of classic state which is known as the Renaissance, or the *cinque*

cento (from its occurring in the fifteenth century), a very notable revival of plaster-work took place in Italy, whence it soon spread all over Europe. This was brought about by the exhumation, under the pontificate of Leo X., of the baths of the Roman Emperor Titus. Raphael Sanzio and Giovanni da Udine, the celebrated artists, were present, and were much struck with the excellence of the ancient plaster exposed. They experimentalised with a view to the discovery of its composition, and having produced an excellent imitation, and executed some fine works in it for the Pope, the new kind of plaster, or *stucco duro*, became immediately popular in Italy, whence the use of it spread to France and England and, indeed, over all Europe.

This *gesso*, or fine hard plaster, was used, amongst other purposes, to model ornaments which were affixed not only to houses but to furniture as decorations.

Amongst other edifices in this country, the celebrated Nonsuch House was covered with ornaments modelled in this plaster.

Later on—in the eighteenth century — the celebrated brothers Adam, eminent architects and decorators, produced many striking works in ornamental plaster, especially elaborate ceilings.

About the same period the fancy of covering the exterior of brick houses with stucco, a species of plaster, became very popular, especially in the English metropolis. Sometimes much decorative work, as an architectural accessory, was under-

taken on stuccoed houses, as columns, balustrades, pediments, porches, and other details.

Stucco, however, is much less popular at the present day, especially in the metropolis and our large towns. This is partly owing to the adoption of a more decorative style of building in brick, and largely to the extensive use of freestone for bay windows, door jambs, and lintels, and other salient architectural features of brick buildings.

Portland cement has been rather extensively used as stucco during the past forty or fifty years in London and elsewhere, but although very hard and fairly durable, it does not present a cheerful-looking surface, and, generally speaking, we may conclude that external plastering does not hold its own, a consequence of altered needs and changes of taste, which at present prefers ornamental brickwork and stone facings, or terra-cotta decorative members.

One of the most extraordinary, notable, and beautiful examples of ornamental plaster work is unquestionably that presented by the interior of the celebrated Alhambra of Granada, in Spain. The decorative work of this edifice forms an object of perennial attraction to travellers of cultivated mind and æsthetic taste, and we may fairly consider its ceilings and walls as the very *ne plus ultra* of ornamental plastering.

The Alhambra remains as the sole memento of the Moorish rulers of Spain. The Moorish race first appeared in the Spanish peninsula in the

year 1091, when they came to the assistance of the Saracens, in the efforts of the latter to resist the Christians. After doing yeoman service for the Arabian Caliph of Cordova, the Moors retired to Granada in 1238, and there established their capital. The Moorish city of Granada comprehended an area of no less than thirty-five acres, surrounded by strong walls and fortified towers, with the Alhambra perched on a hilly terrace as a sort of palace-citadel. Within the *enceinte* of the city walls successive caliphs raised a number of superb edifices, especially lavishing the splendid extravagance of Oriental architectural decoration on the interior of the Alhambra.

The largest and most magnificent chamber in the Alhambra is the "Hall of the Ambassadors." The walls of this room are covered with stuccoed work of the lightest and most delicate kind. Another most celebrated and impressive apartment is the "Court of the Lions," which has been admirably reproduced at the Crystal Palace, at Sydenham. The ornamentation of this court is very fine. Fig. 1 is a reproduction of the central decoration on the front of the doorway leading into the open court of the Alhambra, which faces the fountain of the lions. This illustration is taken from a cast, and is about one-fifth of the size of the original decoration, which is executed in pin-point stucco, the pattern in this instance being *cut* and not *cast*, as is most generally the case in this description of work. The upper and lower lozenge-shaped figures contain

the words in Arabic, "Blessings on our Lord Ben Abdallah," the name of the Sultan of Granada under whom the court was built. Of course, the original stucco plaque is brightly coloured in the primary lines, with what effect untravelled visitors

Fig. 1.—Moorish Plaster Design.

may easily satisfy themselves by going to the Crystal Palace. The engraving is a characteristic representation of the "fanciful arabesques and light relievos which everywhere cover," says a popular writer, "the walls of the Alhambra, and

which, changing under the glance, like the patterns of a kaleidoscope, lend them their peculiar power to charm and fascinate the eye of the beholder. Like the little stories within each other in the tales of the 'Arabian Nights,' the figures are made up of repeated repetitions, so to speak, and yet by their suggestive complexity are ever new and never become wearisome. To the uninitiated the delicate intricacies of the arabesques covering the walls of the Alhambra appear to have been worked out by hand with a minute and painstaking patience. Especially is this true of the domed ceilings, which, with their pendants and stalactites, present patterns of labyrinthine and bewildering complexity. When, however, it becomes apparent that all this is stucco work, our astonishment ceases, although our admiration for the design remains undiminished. The patterns are made in plates of plaster of Paris, cast in moulds, and being skilfully joined together, form patterns of varied form and size. This style of diapering walls with arabesques and stuccoing the vaults with grotto work, came originally from Damascus, but received its highest development and most pleasing imagery from the warm-blooded Moors of Spain.

"The process employed was simple. Preparatory to applying the decoration the naked walls were divided by lines at right angles, such as artists employ in producing pictures. A series of intersecting segments of circles were then drawn over these, and by their aid the artist

could work with quickness and surety. The great instrument of the Moorish artist was the compass, which, however, was not made in the usual way of two limbs of metal joined. It was a fixed measure tied by a string, so that for each dimension there was a different compass."

This elaborate plaster work was not permitted by the Moorish decorators to remain in its unadorned white relief.

"Gilt was very freely applied on the stucco, especially on the vaults and cupolas. Brilliant and delicate colours, such as lapis-lazuli and vermilion, were used in the interstices, being applied with the white of egg. The primitive colours prevail in the Alhambra, wherever the artist or decorator has been Moorish or Arabian. . . . The 'Hall of the Abencerrages' is in the form of a perfect square, . . . and the walls are ornamented with arabesques of the most elegant and intricate designs. The colours still retain their brilliancy, and the delicate beauty of the filigree remains unmarred after the lapse of more than five hundred years.

"The 'Hall of the Two Sisters,' so named by reason of two immense marble slabs forming part of its pavement, is exceedingly beautiful. The stalactite roof is said to consist of five thousand pieces, and though all this plaster ornamentation is supported only by reeds, it still remains well-nigh as perfect as when first placed there."

CHAPTER II.

Tools and Accessories.

The tools employed by the plasterer are few and simple, and neither costly nor troublesome to keep in order. Herein he has a considerable advantage over the artisans of some other crafts. Take the joiner or cabinet-maker, for example. Both require a considerable number of implements, some of them pretty costly, and many of them needing a fair share of "gumption" and experience to keep in tolerable working order.

Hence, even before he is "out of his time," the ambitious young cabinet-maker begins to lay the foundation of a good tool-chest, by acquiring separately, as his pocket will allow, articles, many of which he will but rarely have occasion to use, such as beading-planes, &c., so as to form the nucleus of a good assortment of tools. But beyond the accessories which it is customary for the employer to provide, the journeyman plasterer does not need a very extensive outfit. Of course in our craft, as in all others, the aspiring and ambitious artisan will need more tools than the workman who is contented to jog along in a quiet, old rut; but even if our plasterer be ambitious to

become, say, a designer and good modeller, the

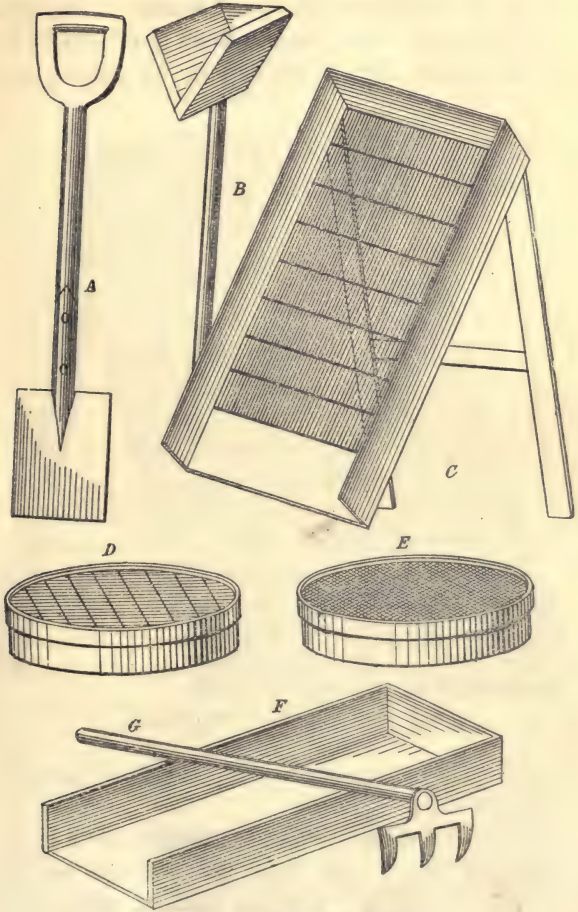


Fig. 2.—Plasterer's Tools.

necessary outfit does not require to be either

large or expensive. The following list comprehends the principal plasterers' tools:

A *spade*, or *shovel*, and *hod* of the same kind as those used by the bricklayer, for mixing and

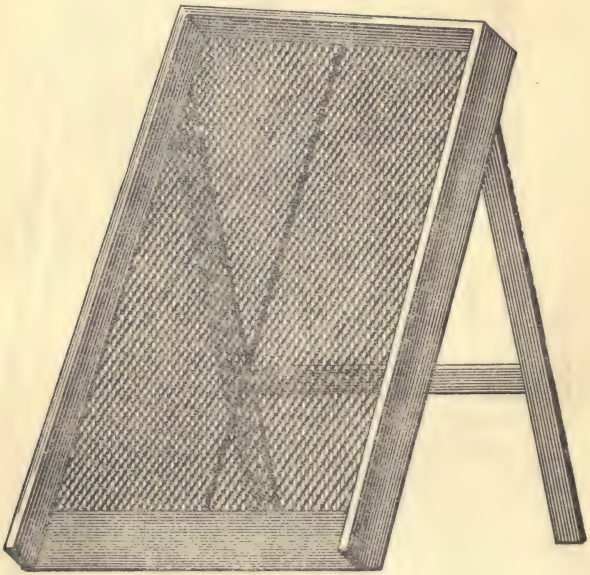


Fig. 3.—Expanded Metal Screen.

carrying plaster (A B, Fig. 2), and *pails* for conveying water.

Screen and Sieves.—These comprehend a large wire "screen" (C, Fig. 2) set up in an oblique or inclined position, against which the materials are thrown with the shovel. The lime and sand mixture for plastering is most ade-

quately combined by passing it through this appliance. Small round wire hand "riddles" or "sieves" (D, Fig. 2), are also employed for separating the coarse from finer particles, and "hair sieves" (E, Fig. 2) for still finer division. The British Metal Expansion Company, Limited, of West Hartlepool, produce a useful form of screen (Fig. 3), made of their patent expanded steel, which is very strong, and excellently adapted for screening lime, sand, gravel, &c.

The *gauging-box* (F, Fig. 2), which is a flat platform of rough board, frequently made with three elevated sides as shown. A pit dug in the ground is often used in place of this.

Larry, Drag, or Rake.—This is a two- or three-pronged rake (G, Fig. 2) employed for combining the hair and other ingredients in mixing hair plaster.

Server or Feeding Spade.—This is a small spade provided with a long handle (I, Fig. 4), and used by the "hawk-boy," or plasterer's assistant, to beat up the plaster on the gauging-box, in order to prevent it setting. He also employs it to take up the plaster and supply his "hawk" with small portions, as the plasterer on whom he is waiting may require.

Hawk.—This is a quadrangular piece of board, about 10 inches square, and provided with a short round wooden handle on the under side to hold it by (J, Fig. 4). This is used for holding the "stuff" on, ready to be applied by the trowel.

Lathing Hammer.—This has a hammer head

on one side, with a hatchet blade at the back;

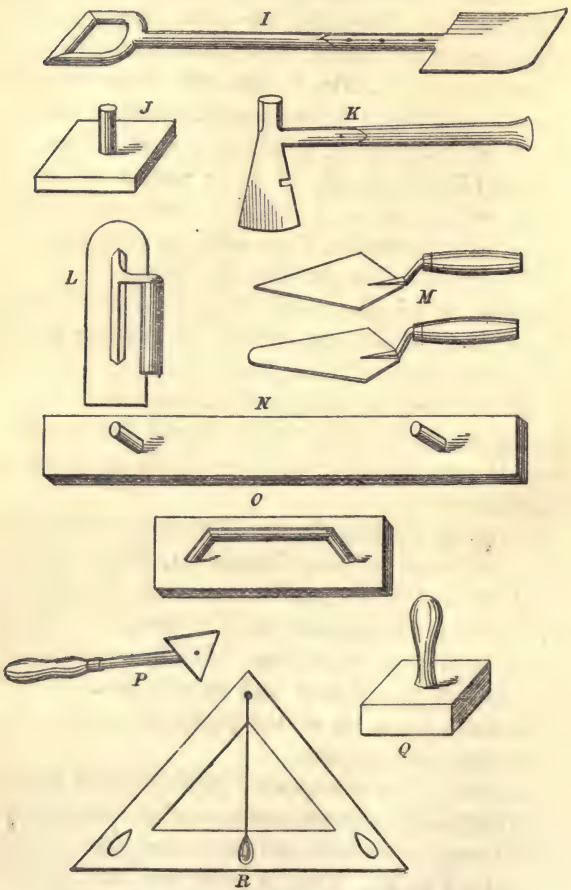


Fig. 4.—Plasterer's Tools.

the latter generally having a notch in it to be

used for extracting nails (K, Fig. 4). The "lathing hammer" is employed in hacking off old plaster, roughing surface to provide a "key," cutting laths to length, and nailing them up. The hammer pane or face is chiselled with diagonal channels in a diamond pattern to prevent it from slipping on the nail-heads.

Trowels.—These are of different forms. There is, first, the "plasterer's trowel" proper, or "laying tool" (L, Fig. 4), which is a thin plate of polished steel, about 10 inches long by 2½ inches wide, semicircular at one end, and square at the heel, with a somewhat convex face, and provided with a wooden handle at the back, fixed parallel with the blade. "Gauging tools," or ordinary trowels, of the same kite-shape as the bricklayer's trowel (M, Fig. 4); but of various sizes, from 3 inches to 7 inches in length, which are used for "gauging" the "stuff." This term "gauging," in this connection, meaning mixing plaster of Paris with it.

Floats.—These are of three varieties—(1) the ordinary "float," sometimes called the "derby," which is a straight-edged piece of board, frequently about 12 feet long (N, Fig. 4), with a flat, smooth face, and a pair of handles, so that it can be operated or worked by two men. This is used in three-coat work, for "floating" the second coat to a level, smooth surface; (2) the "derby," or "hand float" (O, Fig. 4), which is a small bit of flat board, provided with a handle on the back, like the plasterer's trowel, and is

employed for floating and smoothing off finishing coats, also in stucco work, and for many purposes; and (3) the "quirk float," which is a wooden mitre, splayed or bevelled off to an angle at one corner, used for floating in angles as mitres to mouldings.

Straight-edge.—A wooden rule, or long piece of smooth board, with one edge shot perfectly true with the trying-plane. This is used for testing ceilings, walls, or other extensive surfaces in order to insure a perfect level.

Plumb-bob or Plummet.—A leaden ball at the end of a piece of twine, used for trying the straightness of a surface—such as a wall—vertically.

Level.—The same species of triangular level, with a plumb-bob, used by other artisans of the building trades (R, Fig. 4).

Moulds.—These are used for running mouldings, cornices, &c. A mould is a piece of flat wood, usually beech, or plate of brass, or iron cut out to the outline of the cornice or moulding desired to be produced. Usually a pair is required, one less cut out than the other.

Jointing Rule.—This is a wooden straight-edge, generally about 5 feet in length by 3 inches wide, with one edge shot to a bevel. It is used for floating in angles, as at the corners of rooms, and also for marking in "joints" in stucco work as a straight-edge.

Jointing Tools.—These are small triangular plates of steel, of different sizes, furnished with

a handle at the back (P, Fig. 4), and ground up sharp at their corners. They are employed for picking out and finishing off angles and mitres to mouldings.

Brushes.—Various brushes are employed by the plasterer, the most common being the "double-tie brush," used also for white-washing. Brushes are used for dusting, wetting, and colouring. They are usually broad and thin, and of coarse or fine hair, according to the purpose to which they are to be applied.

Picking-out Tools.—Small steel tools, used in clearing out ornaments, moulding mitres, &c., and for modelling (modelling tools proper are described in the Chapter on "Modelling").

Stopping Tools.—The same as "picking-out tools."

Pargetting Stamps.—Square (or other shaped) blocks of beech with *intaglio* designs cut on the face, and a handle fixed to the back (Q, Fig. 4).

CHAPTER III.

Materials.

Lime.—This is the most important substance used by the plasterer, and upon its good quality and careful selection the perfectness of his work depends. Lime is prepared by burning various natural rocks or stones, and varies in nature in different localities according to what species of mineral is readily accessible to supply the kiln.

Ordinary limestone is a calcareous (or chalky) stone, frequently containing a certain proportion of alumina (or clay) and ferruginous (or iron-like) constituents. The first kind is known as "pure"; the latter as "mixed," and this last is held to be the best for the bricklayer's and plasterer's purposes. The limestone is calcined or burned in a proper kiln, and if it has been properly and sufficiently subjected to heat, the resulting product falls into powder on being slaked, or having water applied to it, and being mixed with water and sand (and sometimes hair) in certain proportions, forms a strong plaster and durable cement. Lime in its burnt state as it leaves the kiln is known as "quicklime," and possesses very strong caustic properties, but after it has been for some time exposed to the air it

absorbs carbonic acid gas therefrom, and becomes mild and weak, and less and less adapted for use as time goes on.

Most of the lime used in London is prepared from chalk found largely in Kent; but lias lime, made from rock of the lias formation, is also a good deal employed in the metropolis, although its colour is less white than that of chalk lime. Dorking lime used to be in considerable demand for stuccoing, when that kind of work was popular; but there is not much lime produced at Dorking now.

When the lime has been prepared from a limestone containing argillaceous (or clayey) constituents, in certain proportions, mortar or concrete or plaster made from it possesses the quality of "setting," or solidifying under water, whence this species of lime is known as "hydraulic lime." When lime of this character is used by the plasterer, he should bear in mind that there is apt to be in it, even when well ground, little lumps of unslaked lime, which, even if not larger than a pin's head, will materially injure the appearance of his work by "blowing," or slaking, after the finishing coat has been applied. Want of proper attention to this point frequently results in a new ceiling or partition breaking out here and there in blisters, and thus injuring the plasterer's reputation as an able and conscientious craftsman.

"Fat" limes are principally employed for internal plastering, because of their readiness to

slake into a fine powder, whilst they still "set," or harden, with sufficient rapidity for general purposes.

Blue Lias Lime.—The hydraulic lime formed by calcining rocks of the blue lias formation is extensively employed for building operations at the present day, especially in the Metropolis. Beds of the lias are found over a considerable portion of Great Britain. It was from the lias beds at Aberthaw that Smeaton, the eminent engineer, obtained his hydraulic lime for building the Eddystone lighthouse. Portland cement is manufactured from this stone at Rugby on a large scale. Despite its good properties, this lime is more uncertain in its behaviour than chalk lime, and its manufacturers in their instructions for using it observe :—

"In using blue lias lime for mortar, &c., great care is required in reducing it to extreme fineness, and it is usually done by two ways—slaking or grinding. When slaked, lias lime may be kept with advantage for a week or ten days; but the time depends entirely on the care taken in slaking, and so important is this that mortar may have a great adhesion, or only a small one.

Sands.—It is very essential for the production of good plaster that the sand used should be of the proper kind. Sand of a loamy or clayey character should on no account be used. The sand ought to be of a siliceous (flinty) nature, clean, and of a sharp, gritty character. If the sand is not clean, it should be carefully washed, and as a

general rule, it may be almost safely asserted, that the greater part of the pit-sand usually found requires preliminary washing. If loamy, unwashed sand be used for plaster, it is very liable to render the latter rotten and decaying, and also tends to cause the laths to rot. Sea-sand is entirely unsuitable, as the salt which it contains is pretty certain to absorb humidity from the atmosphere, which makes the plaster damp. Moreover the evaporation of the moisture in dry weather frequently coats the face of the ceiling or walls with an unsightly white efflorescence. If the plasterer be reduced by imperative necessity to use sea-sand, he should take care that it is first well washed in the same way as with clayey sand.

Water. — The water for gauging plasters should be as pure as is procurable, and especially free from those salts which absorb moisture from the atmosphere. Sea-water is, therefore, never to be used, as the salt which it contains is especially obnoxious.

Plaster of Paris.—This, as it enters a great deal into ornamental work, may fairly be reckoned a plasterer's material. It is calcined gypsum, or sulphate of lime, and derives its trade name from the fact that it is found plentifully in the hills of Montmartre, in the environs of Paris, and it is very extensively used in that capital and other parts of France for plastering. That which is principally used in London and England generally is prepared from a sulphate of lime found

in Derbyshire; and calcined plaster of Paris can be obtained in two qualities, viz., "coarse" and "fine." The former is used for gauging or mixing with common lime and hair plaster in order to accelerate its setting. The latter is employed for moulding, casting, finishing coats of delicate work, &c.

Besides the foregoing, which may be considered as the usual and especial materials employed in plastering, a number of more or less novel and valuable compositions are on the market, to which it is well to allude, and which we may classify under the general head of—

Cements.

Besides the ordinary plaster and plaster of Paris, many so-called "cements" are occasionally employed by the plasterer. Common plaster is identical in general composition (except for the addition of hair) with bricklayers' mortar, which is clearly a cementing (or adhesive) material. In fact, whatever substance will "cement" will also "adhere," and may, therefore, be used for wall-coating and similar purposes. The main object aimed at in using hydraulic and other cement is the obtaining of a hard, non-porous surface, capable of resisting the influence of the weather, or wear and tear; as also for sanitary purposes, as being less likely to imbibe foul effluvia, disease germs, &c., in such places as hospital wards, where common plaster might be likely to harbour disease.

Portland Cement. — First comes that well-established article, of great use in the building-trade, known by this name. This cement is, in fact, an artificial hydraulic lime, and was originally composed of the clay of the Valley of the Medway, mixed, in certain proportions, with the chalk of the same district. It was soon discovered that equally suitable materials could be found in other districts, and at the present time much of the Portland cement used in the English metropolis is made at Grays Thurrock, and other places on the estuary of the Thames near the mouth thereof. The materials for the cement are thoroughly ground up together with the addition of water, allowed to deposit, dried, and burned. In the latter process the heat is urged to the point of vitrification: the lime is, in point of fact, overburnt, and frequently irregularly so. Hence great care is required in grinding up the combined products of the calcination, so as to enable them to be regular in their time of setting; for all overburnt limes, as well as natural cements, slake with difficulty in masses, and need to be well broken up or ground to powder before being used. Portland cement also permanently expands in setting, so that it should not be used in positions where this property might interfere with the solidity of the work. Portland cement is extremely useful in external plastering, and also for the first coats of cement dados, skirtings, &c., in interior work. It is best to use the quicker setting kinds, weighing from 90 lbs. to

not much over 100 lbs. per slaked imperial bushel, the great strength of the heavier and slower-setting cement being of no object.

Roman Cement.—The ancient Romans, as I have already noted, were possessed of the knowledge of how to compound a remarkably durable plaster or cement. It is, therefore, not surprising that when Mr. Parker, of London, took out a patent in 1796 for manufacturing a hard building-cement from the nodules of septaria found in the London-clay formation in the Island of Sheppey, he should apply the title of "Roman cement" to the product thus obtained. In his process the stones were broken into fragments, calcined at a high temperature, approaching that of vitrification, and then reduced to powder by crushing and grinding. It was subsequently discovered by Mr. Frost that the septaria of Harwich produced a similar cement, and Mr. Atkinson found that the nodules of the argillaceous limestones of the secondary formation of Yorkshire could also be used for cement. Similar available material has since been found at many places in both the United Kingdom and France.

"While London," says Mr. A. McAra,* "was, and still is, confined to that uncertain and limited source of supply for Roman cement"—viz. Harwich—"Glasgow was favoured by the discovery, about fifty years ago, of the same mineral in

* Paper read before the Institution of Engineers and Shipbuilders of Scotland, 1892.

abundance quite close to her borders. It was discovered by the late Mr. Charles Macintosh, of waterproof fame, who then owned, and resided at, Cross-basket, near East Kilbride. On working the limestone at Calder Glen, the cement-stone had to be removed, and the custom had been to break it up and mend the roads with it. When in England on one occasion, he wrote to his foreman to lay the stone aside, and when he returned he had this hard stone burned and pulverised, the result being a cement similar to that which Parker had discovered in 1796. It is believed that Mr. Macintosh, while in London, had seen the stone which was used for making Roman cement there, and found a resemblance in some respects. Mr. Macintosh named it 'Calderwood Roman Cement,' and it was sold at something like 30s. per barrel. At the present day the price is about a fifth or sixth part of that figure. Roman cement was afterwards found at Orchard, near Griffnock, and near Barrhead, where I am at present working the same cement. This seam is 3 feet thick, and the analysis shows the cement to contain: lime, 48·44; silica, 17·90; alumina, 12·12; iron peroxide, 9·68; magnesia, 1·92."

At the present time, however, Portland cement has almost wholly superseded Roman, the latter having been found not altogether reliable, and its only merit being that it sets very rapidly.

Medina Cement.—This may be considered as

a superior quality of Roman cement, being also made from the Hampshire septaria. It is of a somewhat lighter colour than Roman, and sets very rapidly. It has been used in hydraulic engineering, with considerable success, for pointing and rendering walls exposed to a tidal pressure of as much as fifteen feet of water.

CHAPTER IV.

Special Materials.

In the present chapter (which may be considered as in some sort a supplement to the preceding one) I propose to describe briefly certain specialities (patented or otherwise) of modern manufacturers of builders' materials which may fairly rank under the heading which I have adopted for this chapter.

Martin's Cement.—Pearlash, as well as alum, is added to the plaster of Paris for this cement, and it is baked or roasted at a higher heat than the other. It is a good white cement for internal work, of excellent "covering" powers, and is made in the three qualities of "coarse," "fine," and "finest."

One hundredweight of Martin's cement, with an equal proportion of sand, will cover 6 or 7 yards super $\frac{1}{2}$-inch thick. For walls or floors a $\frac{1}{2}$-inch coat of the coarse cement to $1\frac{1}{2}$-inch clean washed sand, and a $\frac{1}{8}$-inch finishing coat of pure cement is all that is required.

Metallic Cement.—This has a metallic lustre,

and is by some considered especially suitable for exterior work, but is not much used.

Mastic Cement.—Good for outside work, as there is no tedious waiting for drying, and painting can be proceeded with upon it immediately after application. It is not, however, much employed now.

Atkinson's Cement.—The observation just made relative to mastic cement applies also to this. It is warmer-coloured than Portland, and, being quicker setting, is useful for castings.

Selenitic Cement.—Selenitic cement or lime is a comparatively novel material, and, as it possesses some very characteristic merits, I will speak of it at some length. Its discovery was due to the late Major-Gen. H. Y. D. Scott, R.E. "Selenitic cement," observes Colonel Seddon, "has the great advantage of combining cheapness with rapid setting and ultimate hardness, though plasterers say that it requires more lime and labour to work up to a good face than common plasters, whilst experience has shown that fine cracks, called 'fire-cracks,' are liable to develop themselves on the surface, which may be owing to the setting coat being applied too soon, and hardening before the plaster behind has ceased to shrink, or to its hardness preventing it withstanding rapid changes of temperature; and, if the latter should prove to be the case, its use will have to be confined to common work and walls intended

to be papered. The key to its manufacture is that the energetic slaking of a feebly hydraulic lime is stopped by adding a certain proportion of plaster of Paris to the water which is to be used for mixing with the lime, the result being that the lime appears to have the properties of a cement imparted to it.

"Selenitic lime all ready prepared for use, that is to say, ground and mixed with the requisite proportions of plaster of Paris, so as to guard against mistakes arising from having to add plaster of Paris during the process of mixing, is now supplied by agents of the company in most localities, whose names can be ascertained by reference to the company's London office." *

The following instructions for making selenitic plaster have been issued by the Patent Selenitic Cement Company of Lambeth :—

"Throw into the pan (a 5-foot pan is referred to) of the edge-runner two or three three-gallon pails of water, to the first of which one pint of plaster of Paris has been added, and gradually introduce a bushel of prepared lime ; continue the grinding until the whole has been reduced to a creamy paste. The sand, burnt clay, or other ingredients may then be added, and ground for ten minutes more.

"Prepared lime is formed thus: hydraulic limes, such as contain not less than 20 per cent. of clay, are selected by the company, and, after being tender-burned, are very finely ground and

* "Builder's Work and the Building Trades," by Col. H. E. Seddon, R.E. 1889.

mixed with a small percentage of plaster, and are then ready for use.

"When a mortar-mill cannot be used an ordinary plasterer's tub or trough with an outlet or sluice may be substituted, into which pour the water, then add the plaster, and well mix with the water, then gradually introduce the prepared lime, which must be well mixed with the water in the tub. The mixture is then taken from the tub, or run out by means of the sluice, and mixed with sand in the following proportions :—

"*For Brickwork.*—2 pails of water, 3 pints of plaster, 1 bushel of selenitic lime, 5 or 6 bushels of clean sharp sand.

"*For Lathwork.*—2 pails of water, 3 pints of plaster, 1 bushel of selenitic lime (which must have been first sifted through a fine sieve), 3 pails of ordinary lime putty, 3 pails of fine washed sand. This mixture will do for trowelled stucco or pointing mortar for brickwork by adding to the quantity of sand. If preferred, ordinary fine stuff can be used for the setting coat.

"Increase the above quantities proportionately with the requirements. It is of the utmost importance that the order here indicated in preparing the concrete, mortar, &c., should be observed; first putting the plaster in the water, and then the lime in the mixture of plaster and water; otherwise the lime will slake and spoil. The use of ground selenitic (or Barrow) clay improves the mortar, and renders it more hydraulic. When the Barrow clay is used 2 bushels may be added

to 1 bushel of lime, the proportion of sand, ballast, &c., being the same as for lime.

"The following remarks should be observed: That selenitic lime or mortar must not in any case be used where it is required to be gauged with plaster, such as for cornices, screeds, &c. That the sand, ballast, or other ingredients should always be clean and free from loam. When the sand is very dry more water will be required. That there should be no more gauged than can be used during the day. That if the mortar gets heated and sets too rapidly, add to the quantity of the plaster in the gauging. Burnt clay (ballast) or cinders can be used with great advantage.

"Finely ground selenitic clay can be used as a substitute for Parian and other cements. For a finishing coat for stucco use water, plaster, and lime as before, and add 3 bushels of clay and 1 of fine washed sand.

"Plastering on walls can be done by the above process, as two-coat work, while the ceilings can be floated immediately after the application of the first coat, and set in forty-eight hours."

Robinson's Cement.—The patent fireproof cement and Paragon plasters manufactured by Messrs. Joseph Robinson and Co. of Carlisle and London, are well-known specialities. These materials are produced from alabaster or gypsum, are easy to work, set as hard as granite, present a beautifully smooth surface on the finishing coat, and are practically fireproof.

With regard to the latter most important matter in modern house construction, Mr. W. Bedford, analytical chemist, reports as follows:—"I have tested three samples of Robinson's 'Paragon' wall plaster with respect to its fireproof qualities. To the first sample I applied a test of 3,000° Fahr., and found no signs of decrepitation or undue expansion, and, in fact, can certify that the whole of the samples withstood all tests applied in a most satisfactory and surprising manner. I afterwards applied to corners of sample a heat of 3,900° Fahr. without finding any signs of fusion. From the fact that laths in first sample had absorbed from plaster an amount of one of its fire-resisting elements, $B_4 O_5 Na O_2$, I found extreme difficulty in burning them. I further tested first sample by fusing iron wire on its face; the plaster even then did not show signs of failing."

As to the strength of Robinson's fireproof cement, it may be noted that a specimen of it stood a tensile strain of 880 lbs. per square inch; and as to its other qualities, its colour is beautifully white, and a practical plasterer said when floating a wall with Paragon, "This stuff lays on like butter."

These specialities are of two kinds, viz., patent fireproof cement and Paragon plaster, and are produced in the following qualities, at prices from 36s. to 50s. per ton, "A" Paragon plaster, floating coat for walls; "B" Paragon plaster, floating coat for lathwork; "C" Paragon plaster,

floating coat for cornices; "D" coarse No. 2 cement, for floating only; "E" Paragon plaster, one-coat work; "F" fine No. 1 cement, and "G" coarse No. 3 cement, for concreting.

In the firm's model specification of works with Robinson's cement, under the head of "Materials to be Used," they remark, "The sand used to be clean, sharp river or pit-sand, free from earthy matter and other impurities, or, as a substitute for sand, Portland stone dust, or dust from other stone with rough or irregular grains, may be used. It is to be noted that there are few deposits of sand so pure as to render preliminary cleansing or washing unnecessary." Of the cement they proceed, "No. 1 quality to be used for finishing, No. 2 quality for rendering, or for foundations and scratching coat."

The following are the practical directions for the execution of work with the cement:—

"The cement and sand are to be mixed together, dry, in small quantities in the gauging-box, or on any other clean and non-absorbent platform. They are to be run through a $\frac{1}{4}$-inch riddle, and as little water added as will form a paste. They are to be turned over as little as required to incorporate them together, and are to be at once applied to the walls or other surfaces.

"The object in mixing in small quantities is that no more may be mixed together than can be used in one operation. The cement, like all other cements, sets best if undisturbed during the pro-

cess. The cement should therefore be applied as quickly as possible, and with little manipulation, to the walls or other surfaces. Any scraps of material that have set before should on no account be re-used or incorporated with a second mixing.

"The floating should be dashed on and floated off the rule only, avoiding the use of the hand-float or derby for filling. The rougher the finish of the floating, or foundation coat, and the less labour applied to it, the better, the process of setting is less disturbed, with the best results at the least cost.

"The floating must not be scoured or watered, but skimmed or finished off the same day, unless the backing is very damp.

"The materials are to be mixed in the following proportions by measure.

"The floating or first coat on walls, in the proportion of three of sand to one of cement.

"The rendering or first coat on wire netting or laths to ceiling or partitions, one of sand to three of cement.

"The floating coat on laths, one of sand to two of cement.

"The finishing or setting coat to be the best cement (No. 1 quality).

"The water to be used averages $9\frac{1}{2}$ gallons to 1 cwt. of material. The water should be clean. It is to be borne in mind that the less water that is used the less there is to dry out; and that any adulteration, such as the addition of lime, putty,

glue, size, or any other preparation, will show itself by efflorescence, or by the longer retention of moisture.

"Before applying the cement, examine the surface to be plastered, remove all vegetable or animal matter, and see that all nails or ironwork are painted.

"Run and plumb screeds with strong gauging of cement, lay the floating coat on and finish off the rule only, with as expert a touch and as little manipulation as possible, keeping the surface back one-sixteenth of an inch from intended finished face.

"For setting coat, scrape off with the steel trowel any protrusions in the floating coat, and follow on with the dry brush. The setting coat to be gauged with a large wooden spoon in a suitable bath, and applied in three layers. The first application to be laid on with a hand float almost the thickness of lime-putty, and allowed to stand a few minutes, any irregularities are then to be removed with a steel trowel. The surface is then to be sparingly sprinkled with water from brush, and well scoured with hand float, applying a second coat in the process, mixed proportionately thinner. This may remain an hour if a large surface is to be covered.

"It is to be finished by laying on a topping coat of the consistency of milk off the wood hand float, and if intended to be papered or decorated, is to be left with an even but slightly rough face, like the texture of a fine serge

cloth. If intended to be polished or painted in a plain colour it is to be finished with the steel trowel.

"Lath or wire work in summer or good drying weather may be finished or skimmed the same day that it is floated, but in winter or damp weather, the rendering or scratching coat should stand one day.

"Cornices are to be run in of neat cement, No. 1 quality. The moulds are to be cut out of zinc or galvanized iron. The mitring tools used for angles should be of beech."

The following directions for use are also given:—

"*Gauging* (*Floating Coat*).—Use an ordinary gauging-box, empty the required quantity of plaster into it, add the water, and mix to the usual consistency with either hoe or small coal-rake.

"*Gauging* (*Finishing Coat*).—For the finishing coat, gauge it in buckets, rather thinner than ordinary skimming, and let it steep a few minutes before using. Never add water to the cement a second time after it has gone, or you will kill it.

"*Lathwork.*—Laths to be nailed on a quarter of an inch apart. Cleft laths are preferable to sawn ones. Galvanized nails should be used—or the heads of the ordinary ones painted or steeped in oil.

"*Tools.*—Keep the tools as clean as possible, and use a cross-grained beech float for finishing coat.

"*Strength.*—Robinson's pure-finish cement has stood a tensile strain of 880 lbs. per square inch (Portland cement is considered good at 350 lbs. per square inch).

"*Labour.*—It is to be noted that the application of these materials is a continuous process, the workmen going into a room and finishing it straightway, instead of having to wait two or three weeks between the application of the various coats, as in the ordinary lime plastering. The work is as cheap as common lime plastering, when consideration is taken of the saving of time and space, the immediate habitation, and the greatly superior results obtained.

"*Time.*—Rooms plastered with Robinson's fire-proof plaster dry very rapidly, paint and paper can be applied to the walls immediately, and the rooms occupied within a few days after application.

"*One-Coat Work.*—The 'E' plaster can be finished off from the float to a good even surface and made far better work than the ordinary second-rate lime plaster now in use. Thus, taking into consideration the saving in labour alone for this style of work, there is a very great advantage in using the material for even the cheapest building.

"*Decorations.*—If the walls are intended to be painted or distempered, the first coat should be laid on within twenty-four hours after the plasterers have finished the surface, because the cement is then more porous than when it has

become thoroughly dry. The subsequent coats may be applied a day or two afterwards.

"*Alterations, Repairs, Patching, and General Jobbing.*—When required to be painted or distempered on immediately, the edge of the old plastering should first have a thin coat of paint, and the suction well stopped.

"*Castings and Mouldings.*—For castings, a gelatine mould is best, and for mouldings use in the ordinary way.

"*Concreting Floors.*—Robinson's cement 'G' makes a very cheap and perfect flooring, and, if required, boards may be nailed directly upon the surface, the nails holding as well as in wood joists. The concrete may be made with any suitable aggregate, such as broken bricks, clinkers, gravel, or stone, and the cement hardens so rapidly that centres may be struck in two days. A splendid chamber floor can be made for, say, 8s. to 9s. per yard, by iron joists and concrete, evenly floated on top and finished with 3 feet $\frac{3}{4}$-inch pitch-pine boards in narrow widths, nailed direct to the concrete when hard and dry, which is as good as wood block flooring at less than half the cost, and is nearly sound proof, and absolutely fireproof.

"*Whitewashing.*—For whitewashing, one coat of 'F' is superior to two coats of lime or whitening, and very much whiter.

"*Scagliola.*—The bottom to be formed of the 'E' cement used pure, the veneer to be made of 'F' cement of the usual thickness."

Adamant Cement.—A novel variety of patent plaster or cement, to which its manufacturers have applied the name of "Adamant," has been recently placed upon the market. It is a beautifully white, fine plaster, and possesses in an eminent degree the quality of incombustibility. The manufacturers of this speciality (the Adamant Company, of Birmingham) make the following claims for it in their descriptive prospectus :—

"Adamant wall plaster, as its name implies, is a material designed to produce a hard and practically indestructible interior wall and ceiling.

"Adamant has great adhesiveness and considerable elasticity; therefore for ceilings which are liable to spring it is invaluable. It can be frescoed, papered, painted, or treated with any desired finish, within three or four days after the application of the last coat."

"No one," proceeds the prospectus, "who intends building substantially and economically, can afford to use common plaster, when, for a trifling additional first cost, he can have adamant, and have a solid wall that will not be injured every time it is touched by the furniture; that is cooler in summer and warmer in winter, and in every respect superior."

Chromolith is another speciality produced by the Adamant Company, and which they make in white. It is fine finishing material, and is applied thinly over the adamant, uniting with it and making a solid body, and is thus suitable for

finishing the walls of shops, offices, schools, and other buildings. The material, while still soft, may be combed, corrugated, lined, or otherwise worked at will. In all cases where a plain wall in colour is desired the surface should be stippled, instead of trowelled or floated.

Of course the practical incombustibility claimed for adamant by its manufacturers is a quality of so great importance that, if it be verifiable, it cannot fail to bring the plaster into general use, as tending much to the diminution of fire risks. The capabilities of the cement in this direction appear to have been pretty effectually demonstrated by some experiments conducted by Superintendent Tozer, of the Birmingham Fire Brigade, during 1889, as reported in the *Birmingham Daily Times*, where it was stated that—

"Two square structures representing rooms, with chimney-place and entrance, had been erected, the interior of one being lined with the patent adamant plaster, whilst the second was constructed of the ordinary hair mortar. The ceiling of the first structure was composed of adamant pure and simple, and that of the second of the ordinary plaster and laths. Huge piles of small timber and shavings were placed in the rooms, and at a given signal the heaps were ignited simultaneously. In about fifteen minutes the second structure showed signs of giving, the laths at the side first igniting, whilst the plaster commenced to drop from the walls and ceiling. Five minutes later the ceiling caught, and the greater portion fell in with a crash, the fire continuing to burn fiercely. The building of adamant withstood the furious heat. So far, the value of the adamant was proved beyond doubt."

The following are the manufacturers' directions for preparing walls, ceilings, and partitions when using their cement.

"Plugging is better than fixing grounds for adamant. Lath should be not more than $\frac{1}{8}$ inch apart. Machine-riven lath is better than cleft, $1\frac{1}{4}$ inches by $\frac{1}{4}$ inch. If ceilings and partitions are lathed as directed, one bag of No. 2x will do seven yards of work. One bag of No. 2 on brick walls, if reasonably straight, will cover seven yards. One bag of No. 1 does thirty yards of work.

"*Mixing.*—Mix thin with clean water, adding enough dry material to bring it to the right consistency to work smoothly and easily. Do not mix more than can be applied quickly.

"Chromolith it is best to mix stiff in a bucket, and pour out on to a glass or zinc slab, and be careful no dirt or smuts get in.

"*Applying.*—Adamant No. 2, or floating coat, is laid on walls same as ordinary plaster, and ruled off with floating rule to a true face. This should be allowed to set or stand till next day.

"Adamant No. 2x, or floating coat, for ceilings and partitions, is laid on lath the same as on walls. This should also be allowed to set or stand till next day.

"Adamant No. 1, or setting coat, for both walls and ceilings.—Lay on as thin as possible with hand float, then lay down with steel plastering trowel, using a little adamant in each case, and trowelling to a firm face, *using no more water than is absolutely necessary* for final trowelling.

"*Chromolith, or superfine Parian face.*—Float with adamant No. 2 for ground work; finish with

chromolith same way as described for No. 1. If a polished surface is required, the ground work must be floated to a true face. Next day apply chromolith as before described, trowelling to a good face, and then, when about three parts dry, rub with a dry cloth, and a polished surface will be produced.

"Tools to be kept perfectly clean in all cases. This is most essential."

CHAPTER V.

Mixtures.

By "mixtures" I would be understood to mean those amalgamations of lime (or cement), sand, hair, and water, in certain definite proportions, which produce mortars, plasters, cement, &c., ready for application to walls, ceilings, and other surfaces.

These may be roughly classified into "coarse stuff," "fine stuff," "gauged stuff," "putty," and various kinds of so-called "stucco" and "cement."

The materials for all the foregoing I have described in detail in Chapter III., "Materials."

Most of the mixtures may be and are made by hand-mixing; but a machine is to be preferred for producing the amalgamation of some which I will describe elsewhere.

Coarse Stuff.—This is a rough description of mortar, composed of from 1 to $1\frac{1}{2}$ parts of sand to 1 of slaked lime (by measure), with the addition of short animal hair, in the proportions given hereunder.

Coarse stuff varies according to the proportion

of sand which it contains, and may be classed, according to its quality, as No. 1, 2, and 3, the last being the finest and best. A bushel of this mixture should weigh from 14 lbs. to 15 lbs.

The hair may be added in the proportion of 1 lb. to 2 cubic feet of stuff for superior work, and 1 lb. to 3 feet for ordinary work.

The hair should be that of the ox, clean, unbroken, and not too short. It should not be dirty or greasy, and if matted together when it comes from the tan-yard (as it usually is), should be well beaten with a lath or stirred up in water, to thoroughly separate the fibres. For some kinds of work white hair is to be preferred, although for first coats the colour of the hair is of no moment.

The sand is generally heaped up in a circular bank on the gauging-box, platform, or other surface where the plaster is to be mixed. The lime is mixed with water so that the liquid is of about the thickness of cream, and is then poured into the centre of the circle of sand. The hair is next added, and the surrounding sand drawn into the central liquid with the "rake" (G, Fig. 2), and the whole mass well worked together until it is intimately amalgamated.

The mixture should then be left for several weeks to "cool," as it is technically called, that is, until the lime is thoroughly slaked, and its heating entirely killed.

Of course as the hair is added to impart keying or binding quality, it must be in sufficient pro-

portion to attain this end. This can be tested by taking a portion of the mixture on a trowel or bit of slate, and noticing whether it is sufficiently adhesive to hang down from the edge thereof without falling off. If so, the coarse stuff is strong enough for ceiling work. For walls less hair is required.

When the coarse stuff is mixed in a mill the hair should not be added until the mixture is well amalgamated and nearly ready for use, or the abrading action of the runner of the mill will break it up short and much impair its cohesive properties.

Fine Stuff is composed of pure lime, slaked with a small proportion of water into a smooth paste, and subsequently further diluted with water until it is of the consistence of cream. It is then permitted to remain until the slaked lime has subsided, and the superfluous water has either been run off or allowed to evaporate, so that the resultant mixture is of the proper consistency for use.

For some purposes a certain proportion of white ox-hair is added and incorporated.

Plasterers' Putty.—This is prepared by dissolving pure lime in water, and then running it through a hair sieve (E, Fig. 2). It is therefore essentially the same as the mixture last described; but the straining through the sieve, being a more careful preparation, it is still finer,

and is invariably used without any admixture of hair.

Gauged Stuff.—This mixture, which is also sometimes denominated "putty and plaster," is, as the latter term implies, composed of from $\frac{3}{4}$ to $\frac{4}{5}$ plasterers' putty (made as just described), and $\frac{1}{4}$ or $\frac{1}{5}$ of plaster of Paris. This mixture is used for the finishing coat and for running cornices. For the latter purpose equal parts of putty and plaster are often adopted for the mixture.

The addition of the plaster causes this to be a very quick-setting mixture, and it is consequently necessary to gauge it in small quantities. Moreover, as the state of the weather has considerable influence on the setting of the plaster of Paris, the proportion of the latter is increased if the weather be damp. Too great a proportion of plaster, however, causes a tendency to crack in the work.

Stucco.—Stucco is a somewhat indefinite term, used loosely for various mixtures of the nature of plaster, into whose composition common and hydraulic limes enter; and also for several in which cements are constituents. Those in which hydraulic lime is an element were formerly very popular for plastering the outsides of brick buildings, and are still not infrequently employed for a similar purpose. (See Chapter on "Stucco.")

Common Stucco.—This is generally made with 3 or 4 parts of clean, sharp sand, to 1 of hydraulic lime, gauged as before directed.

Trowelled Stucco.—This is intended to produce surfaces which will be subsequently painted, and where a smoother face is therefore required. It is composed of $\frac{2}{3}$ fine stuff (without admixture of hair), and $\frac{1}{3}$ very fine clean sand.

Bastard Stucco.—This is precisely similar in composition to the last mixture, but with the addition of a little hair.

Rough Cast.—This is composed of sand, grit, or gravel, well washed to remove clay or dirt, mixed with hydraulic lime and water in a condition of slaking. It was formerly much used on timber houses, lathed, and was frequently alluded to by our old writers.

CHAPTER VI.

Surfaces and their Preparation.

Plaster, stucco, &c., are generally reckoned by technical writers as amongst constructive architectural materials. This classification can hardly, however, be considered as strictly correct. Concrete may, it is true, be fairly considered as a structural material, seeing that walls, floors, and even entire edifices are formed of it. But both plaster and stucco—as indeed their very names imply—are but covering coats added to a structure already existing.

The surfaces upon which plaster is usually spread may be roughly divided into three: (1) Brickwork; (2) Lathing; (3) Wire netting and other substitutes for lathing (including reeds).

Brickwork.—But little preparation of brick walls to receive "rendering" or stucco is requisite. The brickwork should be clean and free from dirt or lichens. It is advisable to rake out the joints somewhat in the usual manner adopted by bricklayers before re-pointing, as this affords something of a key for the rendering, plaster,

stucco, or cement, and the entire face of the brickwork should be well wetted.

Lathing.—Much of the internal plastering of dwellings, and no inconsiderable portion of external work in some districts, is executed on a stratum of laths attached by nails to the studs or framing of partitions, and to the under sides of floor joists. Laths are thin splines or strips of wood. They are now almost universally made of pine (although formerly oak was generally employed), and are either produced by hand by a process termed "lath-rending," or are made by machinery.

Laths are usually made in three, four, and five feet lengths, but may be reduced to the standard of five feet. They are termed "single" and "double"; the latter are generally about three-eighths of an inch thick, and the former barely one quarter, and about an inch broad. They are sold in "bundles," containing from five to eight score to the bundle.

The laths are nailed to each stud or joist which they cross with two flat-headed cut nails, the lathing-hammer (K, Fig. 4) being generally employed for this purpose. This is a useful compound tool; for while the head is used, of course, to drive the nails, the hatchet side serves to cut laths to lengths when necessary.

Before the lathing proper is commenced, what is called "firring" or "firring-up" should be carried out if necessary. This consists in bringing the surfaces of all the studs or joists to a perfect

level if they are not already so. Sometimes quite rough and irregular timber is used by country carpenters in house construction, and if in such a case a plasterer finds, say, a certain stud has a depression in it, he either causes the carpenter to "fir" it up, or firs it up himself, by nailing bits of lath on it, as shown roughly in section at Fig. 5.

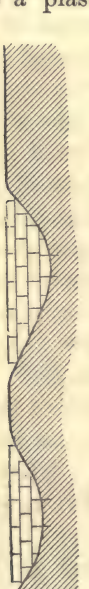


Fig. 5.—Firring-up.

The laths should be attached to each stud or joist they go over by two nails. Their ends must on no account be allowed to overlap, but must "butt" or come into end-to-end contact, so as to lie perfectly "flush" and level.

The laths must be attached to the studs or joists so that they lie in "bays" (Fig. 6) or sections, so that every group of them "breaks joint." This is very requisite, for if a joint were permitted to run entirely across a ceiling or wall on one joist or stud, it would almost inevitably lead to cracking when the plaster became dry. Fig. 6 is a rough sketch in plan of some lathing, partially plastered, exemplifying what I mean; and Fig. 7 is a section through the same. Here J J is a floor joist; *l l l*, battens attached to ditto for lath-

ing ; *l l*, laths ; and P P, a portion of the plastering on the same. It will be seen that the bay of laths, A (Fig. 6), butt up to those of B on batten 1, while in bays C and D the laths butt on batten 2, the centre of laths of C crossing batten 1. Thus joints are broken at every short distance.

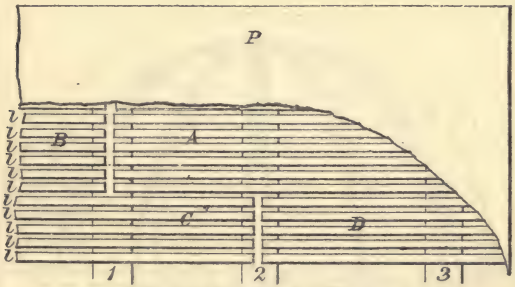


Fig. 6.—Lathing and Plaster.

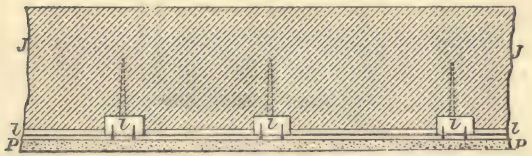


Fig. 7.—Section of Ceiling.

The laths should be nailed "finger" (*i.e.* $\frac{1}{4}$ in.) apart, and the nails should be driven "home."

If Robinson's or some other cements are to be used for the plastering, the heads of iron nails should be touched over with paint, and the latter allowed to dry before the plaster is applied.

In lathing groins, niches, cupolas, &c., especially those with hemispherical heads or tops

(Fig. 8), considerable care has frequently to be exercised to lath the carpentry adequately. In all such cases especial care should be taken that the ends of the laths invariably butt, and never overlap.

The foundation or substratum of cornices is

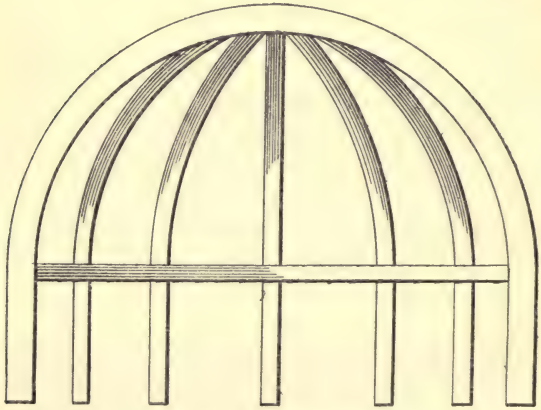


Fig. 8.—Framed Cupola.

principally formed of laths, and this is effected after the following manner:—

The artisan first examines the drawings of the finished cornice handed to him to work from, and measures the projection of the most salient members. If the mouldings be very small and project little, the workman may probably decide that he can produce them by "dubbing out" in coarse stuff, aided, if necessary, by a row of nails or bits of projecting tile. For a moderate amount of

projection, spikes driven into the wall and some tow wound around them, and from one to the other, are often found sufficient.

But for a cornice which projects, say, more than 8 or 9 inches, "bracketing" must be adopted. Brackets are made of pieces of wood cut roughly to an approximation to the outline of the cornice. These are plugged to the wall at intervals of 11 or 12 inches from each other all round where the cornice is proposed to go, and then laths are nailed to these. Sometimes the carpenter makes a "cradling," or regular framework, to receive the laths, and fixes it up. (See Chapter on "Cornices.")

In some districts of England reeds, fixed up, are used as a surface for plastering on. Mr. Edward Dobson observes: "In the Midland districts of England, reeds are much used instead of laths, not only for ceilings and partitions, but for floors, which are formed with a thick layer of coarse gauged stuff upon reeds. Floors of this kind are extensively used about Nottingham; and, from the security against fire afforded by the absence of wooden floors, Nottingham houses are proverbially fireproof." *

* "Rudiments of the Art of Building." By Edward Dobson. London: Crosby Lockwood & Son.

CHAPTER VII.

Substitutes for Lathing.

Besides the expenditure of time involved in the lathing of a ceiling or partition, this kind of foundation for plaster labours under a very grave objection, viz., its great combustibility.

That being so, it is not surprising that in the present day, when architects are so keenly alive to the necessity of using all precautions against fire, ingenious minds should have endeavoured to discover some substitute for laths which should be free from this objection.

The free use of iron in modern constructions, in columns, girders, and beams, to replace the old wooden posts, bressumers, beams, joists, &c., naturally directed their thoughts to this substance. This has led to the utilisation of iron-wire netting of fine mesh for the purpose, and this has been employed in various ways. Of course its use confers a greater degree of incombustibility as compared with wood laths, but it is difficult to plaster upon; the "key" is not so good, and the surface more difficult to level.

This has led Messrs. Samuel Wright & Co., of London, to combine plaster and a wire foundation in their "improved fibrous slabs," which they supply ready for affixing to the structural wood or iron-work, and which, when properly attached, almost entirely obviate falling ceilings, and are highly fire-resisting.

The modern fashion of lining shops, offices, and rooms, both walls and ceilings, with inflammable match-boarding, is a most unsafe and unwise practice. (On this subject, see further in Appendix, p. 167.)

Expanded Metal.—Another novel substitute for wooden laths as a foundation for plaster is the "expanded metal" manufactured by the British Metal Expansion Company, of West Hartlepool. This ingenious invention (Fig. 9 shows a strip of steel partially expanded) cannot fail to prove very useful in fireproof construction, and its uses in that department of building are thus set forth by the manufacturers:—

"Expanded metal lathing is made exclusively from strips of steel expanded into sheets of lathing, from 18 inches to 2 feet in width, and cut into lengths of 8 feet. The shape and size of the meshes and strands forming these sheets are shown by the illustration, which, it will be observed, presents a uniformly waved surface in two directions diagonally across the plane of the sheet.

"The sheets, which are $\frac{1}{4}$ inch wide in the

strands, require no stretching; as to rigidity, require no furrowing, and are easily and quickly applied. With the use of a small pair of tinner's

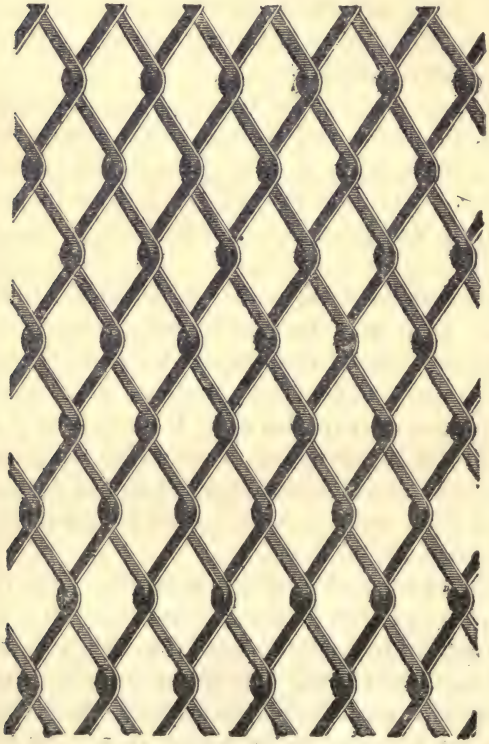


Fig. 9.—Expanded Steel.

shears this lathing can be cut into any necessary shape or size, and by hand pressure can be made to conform to any curve required by cornices and mouldings, and when so conformed retains itself

in position, and is amply rigid without back-stayings. The shelf-like strands composing these sheets provide perfect lodgment for the mortar, and permit of perfect connection between the keys (see Figs. 10 and 11, where the front and reverse sides of a surface of expanded metal, part plastered, are respectively shown), the holding qualities of the flat strands, with their square corners, being

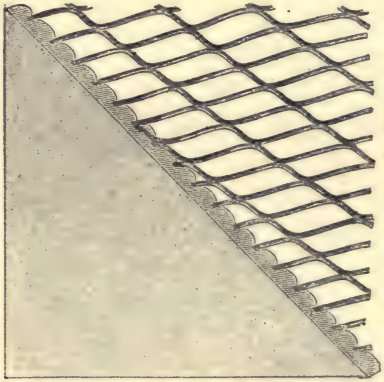


Fig. 10.—Expanded Metal Surface partly Plastered (front side).

of great advantage compared with round wire lathing. The lathing and plastering, when thus applied, becomes a homogeneous mass throughout the whole area of the wall or ceiling, and being perfectly uniform in thickness and flat, the plastering cannot crack. Heat will not expand or cold contract the lathing to disturb the plastering, and a fall of the same through any ordinary

cause, such as jarring or water-soaking, is impossible.

"Its perfect vermin-proof qualities are also a most valuable consideration."

The expanded metal lathing is peculiarly applicable for attachment to iron girders, beams, columns, &c., in fire-proof construction. One of the great objects proposed by the employment of

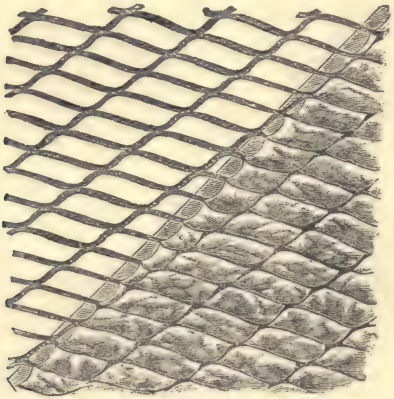


Fig. 11.—Expanded Metal Surface partly Plastered (reverse side).

such metal constructional members is, of course, to render the edifice wherein they are used as fire-proof as possible. The result of all experience, however, has gone to show that iron girders, &c., require themselves to be protected in the event of a conflagration in a building. Under ordinary conditions this is impracticable; but it is easily accomplished by suspending expanded metal

lathing a short distance, say 1 inch, below the girder (Figs. 12 and 13). In this way the plastered ceiling is as substantial, or more so, than it would be if in direct contact with the iron member, and an air-space is thus provided between the flooring above and the plastering, as well as beneath the lower surface of the joist, through which space the air can have free circulation. The entire contents of a warehouse or store-room might with this construction be consumed by fire and the joist remain unaffected by the heat therefrom.

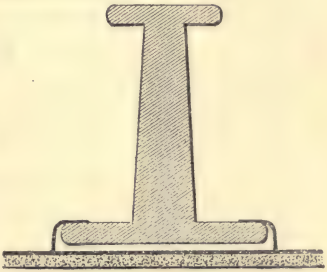


Fig. 12.—Expanded Metal under Girder.

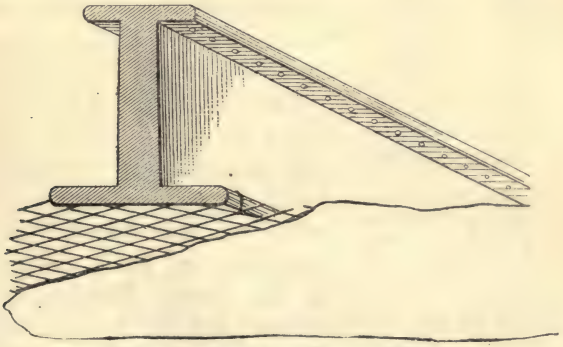


Fig. 13.—Metal and Plaster Ceiling.

Furring strips are stated to be not essential to the use of this lathing in any case, as it provides ample key when secured to a flat surface, as is often desirable to do on the faces of girders and beams, in which case it is easily bent around the lower flanges, and thus applied is self-supporting. It is common practice to wedge angle-iron on wood strips vertically between the flanges of the iron bearers, and to these secure the lathing.

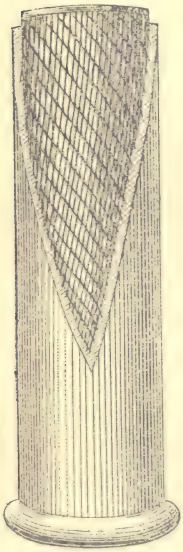


Fig. 14.—Iron Column, with Expanded Metal and Plaster.

Iron columns of structures can and should be protected by "expanded metal" lathing, furrowed sufficiently to leave an air-space between them and the plastering. Fig. 14 represents an iron column covered.

The capabilities of this speciality in this direction were well illustrated by the capital model of the Eddystone Lighthouse at the Royal Naval Exhibition of 1891, designed by Sir James Douglas, and built by Mr. D. Charteris; and the latter gentleman wrote thereon as follows:—"I am much pleased with the results obtained by the use of your Expanded Metal Lathing on the model of the Eddystone Lighthouse built by me at

the Royal Naval Exhibition, London. It was a problem with me how to obtain an uniform outer circular surface on which to effect the perfect imitation of cut stone with the use of cement and at the same time to ensure it against cracking. Wood lathing, in this as in all instances where exposed to damp or water, swells and cracks the mortar, so often the cause of falling ceilings. This cannot occur with your lathing; and, further, its fireproof qualities alone should ensure its general adoption. It is rapidly applied, and secures an uniform surface, which are elements of economy reducing the cost of the finished work to about the same as with the use of wood lathing."

CHAPTER VIII.

Plastering.

The tools, the materials, and the manner of mixing the latter, having all been dealt with in previous chapters, I will now turn to the practical application of the plaster, dealing with the various styles of plastering under the heads of the technical terms by which they are respectively known in most parts of the kingdom.

Laying.—This consists in spreading a single coat of lime and hair all over a ceiling or partition, carefully observing to keep it even and smooth in every direction. This, as consisting of one coat only, is the cheapest kind of plastering.

This kind of work on laths is variously termed "lath and lay," or "laid," or "lath and plaster, one coat," which latter is the term used in the Government specifications.

Pricking up.—"Pricking up," or first coating, is executed in the same manner as the preceding, but is only a preparation for a more perfect coat. It is executed by spreading, with the plasterer's trowel, a single coat of lime and hair mixture upon a ceiling or partition, taking care to keep the coating everywhere regular and

of equal thickness. The stuff should be worked on with the trowel with a sufficient amount of pressure to force it through the interstices between the laths (which, if the plaster be of the proper consistence, it will readily do). This causes the plaster to "key up," that is, when dry, the portion of it thus squeezed between the laths and partially over them clinches, or laps over on them and helps to retain the coat in its place. After this coat is laid it is scratched all over its surface, before it sets, crosswise diagonally with the end of a piece of lath, or a "scratcher" made of laths. This is done to afford a "key," or "tie," for the following coat, so as to enable the latter to adhere firmly and tenaciously. On brick walls the laying on of this coat is termed "rendering," instead of "pricking up."

Two-coat work; or Lathing, laying, and set; or Lath, lay, and set.—These terms are employed when the work, after being lathed, is covered with one coat of lime and hair, which is slightly scratched over with a birch broom whilst moist. A thin and smooth coat of "putty" (see Chapter V., "Mixtures"), or fine lime and hair plaster, is afterwards laid over this. The surface of the first coat requires to be wetted before the second is applied. This latter coat is spread with the ordinary smoothing trowel, which the plasterer holds in his right hand, holding meanwhile in his left a large flat brush made of hog's bristles (see Chapter II., "Tools"). As he lays on the "set," or "putty," with the trowel, he draws the brush,

previously dipped in water, backwards and forwards over it, and thus produces a tolerably level surface, sufficiently smooth for common work, which this is.

Lathing, floating, and set.—This differs from the preceding in having the coat which follows the pricking-up one "floated," or levelled by a 'float" (see Chapter II., "Tools"), instead of simply by the smoothing trowel, a much more perfect surface being thus obtained. Hence this method is adopted for all well-finished work.

While it is still soft the pricking-up coat should be well scored to form a key for the next coat. This is effected by scratching the entire surface criss-cross fashion with the end of a lath, the scorings being two to three inches apart. Some use an iron scoring-tool specially made for the purpose, instead of a lath, and some a scratcher made of laths, with bits of wood inserted to form teeth as it were.

The pricking-up coat being dry and ready, all the parts of the surface (if it be a wall) are tried with a plumb-line to ascertain whether they are perfectly flat and level, a straight-edge or level being similarly used to test ceilings. Should any places be low or depressed, the hollow is brought up by filling it with the lime and hair mixture until the surface is perfectly level. This process is known as "filling-out," and when it is completed the "screeds" are next run.

A "screed" means a fillet or style, formed of lime and hair plaster of the thickness that the

coat of plaster is intended to be and about 7 or 8 inches in width, gauged quite true by drawing a float or straight-edge over it. These screeds are formed at the distance of about three or four feet from each other in a vertical direction, or from ceiling to floor all round the room. The usual manner of forming the screeds is to fix a nail into the pricking-up coat, near the ceiling (or floor), driving it so far in the plaster that it protrudes just the distance that the thickness of the floating coat is desired to be, which is usually about half an inch.

The wall is next to be plumbed from the wood-grounds near the floor. A straight-edge is then applied to the wall, and if the latter be found to be level, a second nail is driven in at the end of it, and left just the same height as the first. Other nails are similarly fixed until they form a row right up the wall. Then another row of nails is driven in at a distance of about 7 or 8 inches from the first. Then mark out the position and breadth of a screed. Similar double rows of nails are fixed all across the wall at intervals of about 3 or 4 feet from each other.

The same thing is done over the surface of the ceiling, a screed being first formed at the projection of the future cornice. Some "stuff," or lime and hair mortar, is then laid on in places between the double rows of nails, and made perfectly level and straight with a short float, working on the nails. These dabs of mortar are technically known as "dots," and are formed at

each length of the level or straight-edge, that is to say, at about 10 or 12 feet asunder. When these are set enough, the spaces intervening between them are filled in with stuff and finished off with the float, which should be about 2 feet longer than the level, so as to have a good bearing on the dots.

The ceiling or wall is now ready for floating. For this purpose the plasterer is provided with a "float," which is a stout, straight, smooth piece of wood (N, Fig. 4), generally from 10 to 12 feet in length, and which requires to be manipulated by a couple of workmen. The space left between the screeds are now filled up flush with "stuff," and made even with the tops of the screeds. The floating-rule or straight-edge is then worked backwards and forwards, resting on and along the screed, by the plasterers, until the whole of the floating is perfectly level, and of one thickness, the float in its progress forcing off all superfluous plaster.

If any inequalities appear either in wall or ceiling after this operation, the "derby," or hand float (O, Fig. 4), is sometimes resorted to in order to obviate them. But this should not be necessary if the floating has been carefully done.

The screeds for floating walls are adjusted by the plummet, and those of the ceilings by the level.

It may be noted with regard to materials that a square (100 yards) of lathing is estimated to take 20 bundles of laths, and 7,600 nails. For a

square of rendering 20 bushels of lime, 40 bushels of sand, and 3 bushels of hair are required; 100 yards of floating need about half these quantities.

"*Pargetting.*"—The terms "pargetting," "pergetting," or "parge-work," were and are applied somewhat loosely, and are used in several distinct

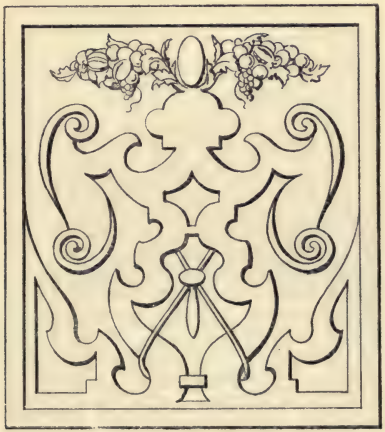


Fig. 15.—Pargetting.

senses, sometimes for plain plastering on walls, but usually for that of an ornamental character. In this sense, it may be described as plaster, enriched by stamped designs. This species of work was at one period very popular in this country, and somewhat of a revival of it is again taking place, principally for the decoration of country houses and of suburban half-timbered

villas. A notable instance, however, is to be seen in the front outer walls of a house in Fleet Street, in the City of London (north side, near Ludgate Circus), which was erected a few years ago by Messrs. Collinson and Lock, though not now (1892) occupied by them.

The ornamentation in pargetting is effected by

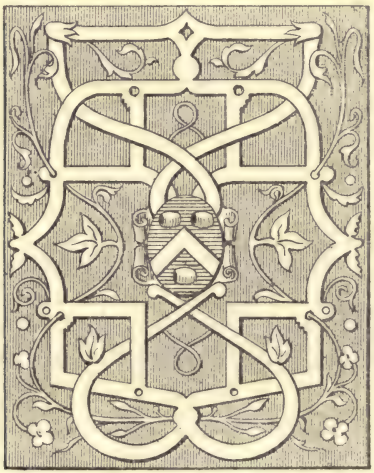


Fig. 16.—Parget Pattern.

mouldings, foliage, figures, and other enrichments, produced in relief or *intaglio* (depressed) by wooden or metal stamps, or even by the point of the plasterer's trowel, if he be sufficiently artistic and expert. In old work, these patterns and ornaments are found sunk in the surface of the plaster, or formed upon it in a smoother mate-

rial than the rest. Timber houses of the time of Queen Elizabeth are often found with the exterior ornamented with pargetting. In the market-place at Newark, states Mr. Parker,* is a wooden house, with small figures and canopies over them

Fig. 17.

in plaster-work, between some of the timbers, of earlier date.

Fig. 15 shows an ancient example from Banbury, Oxfordshire; Fig. 16, another (an extremely elaborate Renaissance design) from Oxford; and Fig. 17, part of the *façade* of Bishop King's house at Oxford, the pargetted plaster of which

* "Glossary of Architecture," vol. i. p. 341.

is well preserved, and contrasts admirably with the dark woodwork of the bay windows. Fig. 18 represents a parget stamp, for use with other stamps, to be combined into designs.

The word "pargetting," although now but little used, except by bricklayers for the coarse plastering of the inside of chimney flues, often occurs as applied to ornamental work in ancient records, as the following extracts show:—

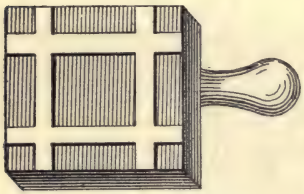


Fig. 18.—Parget Stamp.

In the "Hist. Dunelm." (A.D. 1450) is an entry which reads, "Johanni Bevis pro pargettyng and blanchyng Vs." "Blanching" here doubtless means whitewashing. In the "Durham Household Book" (A.D. 1532) mention is made of the "pargenynge." In the "Survey of the Manors of Wimbledon" (A.D. 1649), we find this entry, "Above which (waynscot) is a border of freet or parge-work wrought, having therein set eleven pictures of very good workmanship; the seeling" (ceiling) "is of the same fret or parge-work."

CHAPTER IX.

Mouldings.

It is often desirable to relieve the monotony of a large extent of plain flat surface, such as a wall, by some projecting member, and hence in external walls we find plinths, string-courses, architraves, &c., added. Also in rooms it is desirable to conceal the ungainly right-angle made by the junction of the wall and the ceiling, and in order to do this a "cornice" is "run" or formed at the points of junction. These cornices are usually composed of members of what are known as the "classic mouldings," and as the running of such cornices is a part of the plasterer's business, I think it well to enter into details of the nature of such mouldings, before treating of making them in plaster.

In the illustrations which I give herewith, Fig. 19 is a quarter-round, Fig. 20 is a "cavetto," being exactly the reverse of the last figure; both being quarter-circles. Fig. 21 is the "cyma-reversa," composed of two quadrants (or quarters of a circle). Fig. 22 is the "cyma-recta," being the reverse of the preceding figure, the "cyma-reversa." Fig. 23 is a "torus,"

which is a semicircle inscribed on a vertical

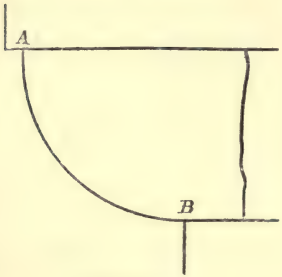


Fig. 19.

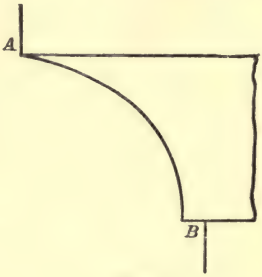


Fig. 20.

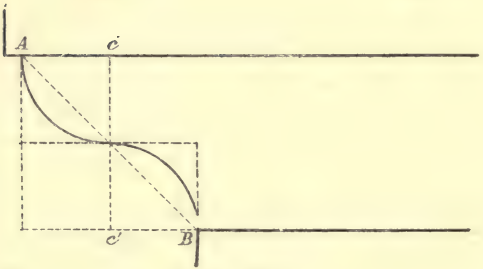


Fig. 21.

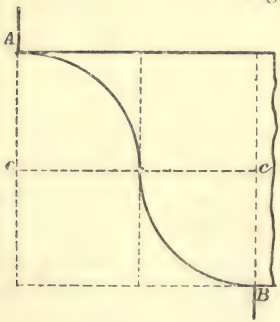


Fig. 22.

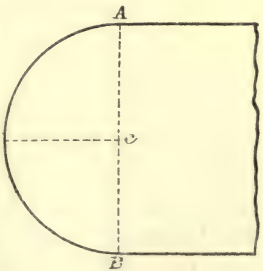
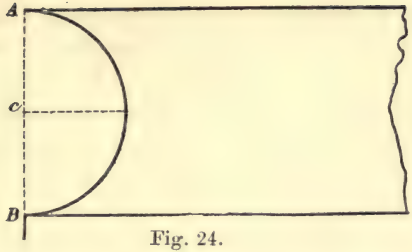


Fig. 23.

diameter. Fig. 24 is a "scotia," which project-



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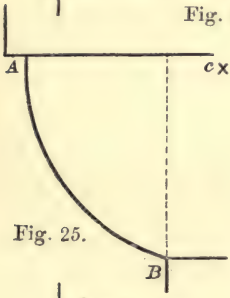
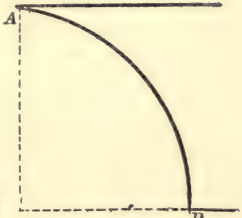


Fig. 25.



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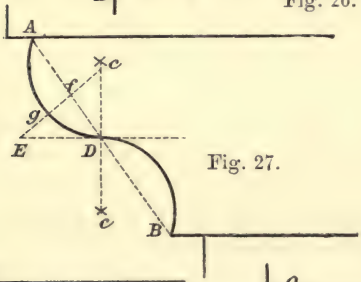


Fig. 27.

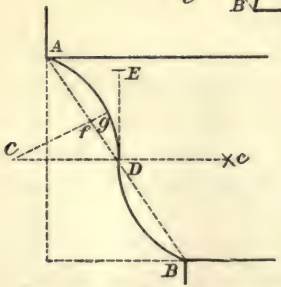


Fig. 28.

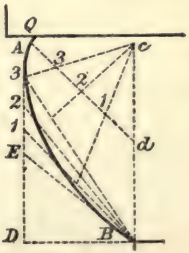


Fig. 29.

ing equally at each extremity, occasions the contour, or outline, to be exactly the reverse of the "torus."

I will now proceed to give the method of describing, or drawing, the figures mathematically, taking the Roman form first, and afterwards that of the Greeks.

In these cases the projections and heights are unequal, the extremities of the mouldings, or extreme points, being supposed to be given to work from.

To describe the Roman ovolo (Fig. 25). Let A be the upper extremity and B the lower; take the vertical line or height; from B with that radius describe an arc; from A with the same radius describe another arc, cutting the former at *c*; then from *c* with the same radius describe the arc A B, which will be the contour required.

To describe the cavetto (Fig. 26).—With a radius equal to the height of the moulding, from the points A and B describe arcs, cutting each other in *c*; then from *c*, with the same radius, describe the arc A B, which will give the contour of the cavetto required.

To describe a cyma-reversa that shall touch a straight line at the points of contrary flexure.—Join the projections A B (Fig. 27) by the straight line A B; bisect A B in D; draw the tangent E D parallel to a line given in position; through D draw *c c*, perpendicular to E D; bisect A D by a perpendicular, *g c*; from the intersection *c* describe the arc A *g* D; make D *c* equal to D *c'*;

from the lower points c', describe the arc D B; then the curve of contrary flexure A D B will be the cyma-reversa required.

To describe a cyma-recta to touch a straight line at the points of contrary flexure, parallel to a line given in position.—Join the points of projection A and B (Fig. 28); bisect A B in D, and draw the line D E parallel to the line given in position; bisect A D by the perpendicular $c\,g$; from c, with the radius c D, describe the arc A D; make D c' equal to D c, and from the other point c' within describe D B; then A D B is the cyma-recta required.

To describe the Grecian ovolo, two tangents being given, as also their points of contact.—Let A E and E B (Fig. 29) be the tangents, A and B the points of contact; complete the parallelogram B E A d; produce B d to c and make $d\,c$ equal to d B; divide E A and d A each into the same number of equal parts; through the points of division in E A draw lines to B; draw lines to c through the corresponding points in d A, to meet the corresponding lines drawn to B; and the intersections will be the curve of an ellipsis. The upper part A Q is a continuation of the same curve.

The same directions extend to Figs. 30, 31, and 32; but the following distinctions must be observed.

In Fig. 29 the tangent B E is regulated by taking the point E in the middle of A D. In Fig. 30 the point E is one-third of A D from the bottom; in Fig. 31, in the middle of A D, as in

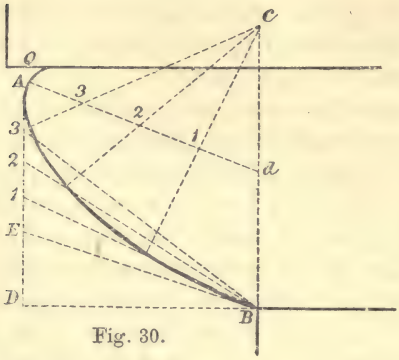


Fig. 30.

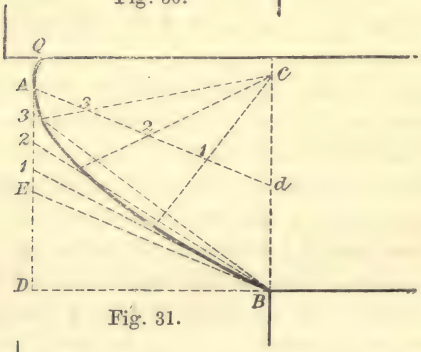


Fig. 31.

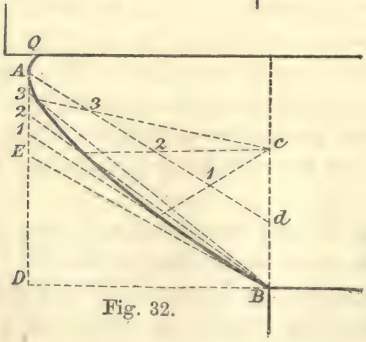


Fig. 32.

Fig. 29, and in Fig. 32 the point E is one-third of A D from A. Then, according as the tangent is lower or higher, the curve will be quicker or flatter at the same projection; so that among these curves, Fig. 30 is the boldest, and Fig. 32 the flattest.

When E B and A E are nearly equal, the moulding is the boldest of any, taking D E at the same height; but when the projection is very great or very small, the moulding is extremely flat.

The same data being given, to describe the Grecian ovolo, supposing the point of contact, B, *to be the extremity of one of the axes.*—Draw B K (Fig. 33) perpendicular to E B; also P *c* perpendicular to B K for the other axis; so that the point P may be above A; then E B and P *c* will be parallel. *To find the Major axis:*—From A, with the distance B *c*, describe an arc, cutting P *c* at F; draw A F and produce it to meet B K in I; make *c* P equal to A I; then with *c* P, half the major axis, and with *c* B, half the minor axis, describe the curve B A P Q, which will be the moulding required. This is the most beautiful moulding of any.

The same description applies to Figs. 34 and 35. With regard to the quirk at the point Q, it will be more or less as the point A is more or less distant from Q.

The quantity of curvature depends on the angle E B D; so that when the angle E B D is less, the curvature will be greater.

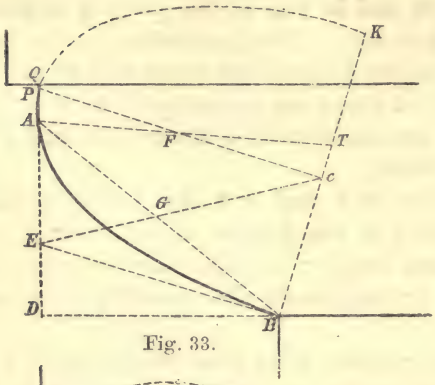


Fig. 33.

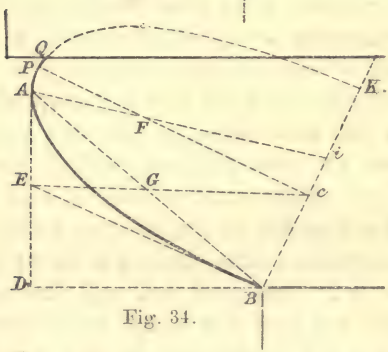


Fig. 34.

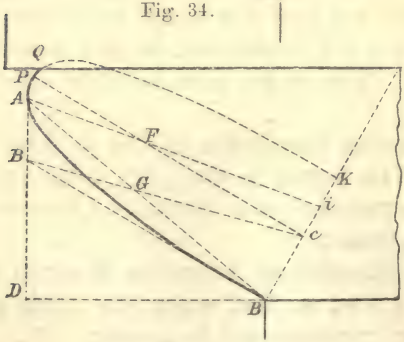


Fig. 35.

Raking Mouldings.—By a "raking moulding" is understood a moulding the arrises of which are inclined to the horizon at any given angle. For example, the sloping cornice of the upper part of a pediment surmounting a door or window comes under the denomination of raking mouldings.

The general rule for these is this: If the raking moulding has to meet with a horizontal moulding at a given angle on the plane, and if the section of the horizontal moulding be given, the following method will show how to find the section of the raking moulding.

Let the given moulding, say, be a cyma-recta (Fig. 36). Take any number of points—1, 2, 3, 4—in the curve, and through these points draw straight lines parallel to the rake; then the moulding shown in the middle of the rake (Fig. 36), being pricked off from the level lines at the bottom, will give the section to work the raking moulding.

If the moulding is required to be returned, as shown at the upper part, the lines are continued; the proper projections are set at the top of the moulding, and vertical lines are drawn through the points of the section to meet the respective inclined lines; then a curve, being drawn through the points of intersection, will give the horizontal return moulding at the top.

Fig. 37 represents an inclined cavetto, showing the section of the raking moulding, and also the section of the return level moulding at the top.

Of course no one or two of the mouldings just described will constitute an effective cornice for an ordinary room. In order to produce a good

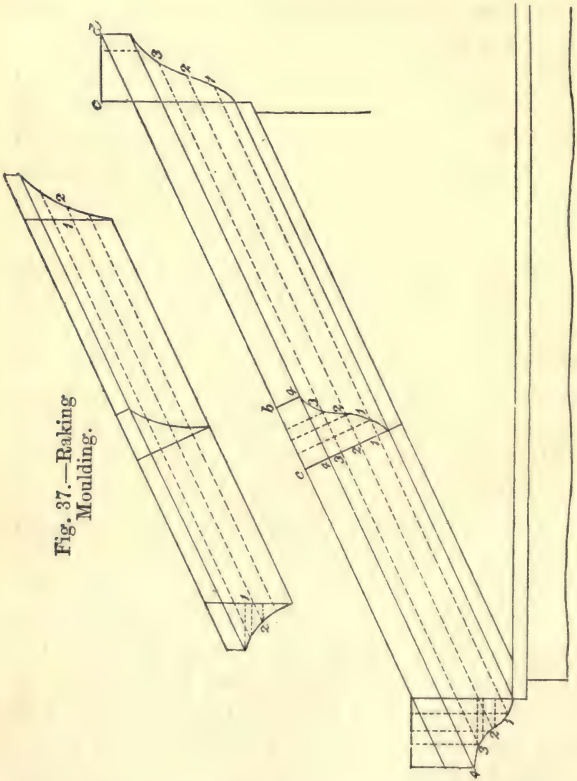


Fig. 37.—Raking Moulding.

Fig. 36.—Raking Moulding.

cornice it is necessary to group several mouldings together, in such wise that the salient and retreating members agree fitly and form a thoroughly

harmonious whole. This is done in the architect's office, and the plasterer is furnished with detailed and accurate drawings of the profiles of the cornices for the various rooms, and from these he instructs the joiner or other wood-worker to prepare a pair of moulds for each cornice, one of the exact size and the other with the outline cut out a little less than its finished contour.

Cornices are either plain or ornamented; and sometimes they embrace a portion of both classes. In executing them, the first thing is to examine the drawings, and measure the projection of the members. If these project more than 7 or 8 inches bracketing must be resorted to. This consists in fixing up pieces of wood at a distance of about 11 or 12 inches from each other, all round the place proposed for the cornice, subsequently nailing laths to them, and covering the whole with a coat—or coats—of plaster, allowing in the brackets for the stuff necessary for making the cornice; for this, in general, about $1\frac{1}{4}$ inches is sufficient. Fig. 38 is a section of a cornice produced as described.

A mould, or template, of beechwood is next to be made of the exact profile of the intended cornice, by the carpenter, from stuff of about $\frac{1}{4}$ inch thickness, with the "quirks," or small sinkings, made of brass.

The plasterers now gauge a couple of "screeds," one upon the ceiling and the other upon the wall beneath the cornice, covering as much of each as will correspond with top and bottom of the in-

tended cornice. These are formed of putty and plaster.

Then the workmen (two operating together) proceed to "run" the cornice.

A tub of putty is provided, mixed with about

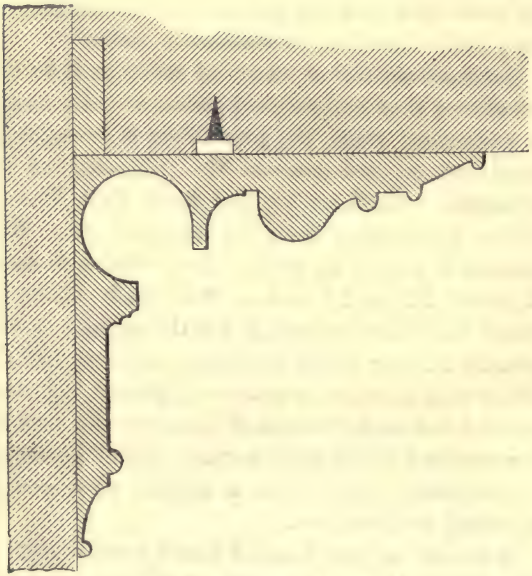


Fig. 38.—Section of Cornice.

one-third of plaster of Paris, and brought to a semi-fluid state by the addition of clean water.

One of the workmen, with two or three trowelfuls of this composition upon his "hawk," now begins to plaster over the lathed surface intended for the cornice, while his partner applies the

wooden mould to the work to ascertain the places where less or more plaster may be required.

When a sufficient quantity of plaster has been laid on, the workman with the mould, holding it steadily and firmly against both the ceiling and the wall, moves it backwards and forwards, which removes the superfluous stuff, and leaves an exact impression of the face of the mould on the plastering along which it was run. This is not, indeed, effected at once, but while the one man works the mould along, the other takes notice of any deficiencies, and adds small quantities of stuff with his trowel where required.

In this manner a cornice of from 10 to 12 feet may be run in a very short time; indeed, expedition is essentially requisite, as the addition of the plaster of Paris occasions a very great tendency in the putty to set quickly. To prevent this taking place too rapidly, it is necessary to sprinkle the composition frequently with water from a brush, as plasterers generally endeavour to finish all the lengths or pieces between any two breaks or projections at one time, to secure the truth and correctness of the cornice.

In cornices of very large proportions, and where the orders of architecture are to be applied, three or four moulds are requisite, which are applied in the same manner, until all the parts are formed. Internal and external mitres, and small returns, or breaks, are afterwards filled up or modelled by hand, an operation upon which a dexterous plasterer reasonably felicitates himself not a little.

When cornices are what are technically termed "enriched," or charged with ornaments, the plasterer leaves certain sinkings or indentations in the mouldings in which such separate ornaments are placed. These decorations were formerly executed by hand, by a description of artisans known as "ornamental plasterers"; but they are now cast in plaster of Paris, which has quite superseded the old style of production.

The more usual methods practised by the plasterer for work of this description are moulding in wax and moulding in plaster, both of which I have elsewhere described. The former is used for all kinds of cornice and ceiling enrichments, such, for example, as friezes, soffits, dentils, &c., and for centre-pieces and bosses, pendants, &c. Moulding in plaster is usually resorted to for large works, which, from being undercut, are not easily to be executed in wax moulds, such as coats of arms, trophies, and capitals attached to trusses.

When the wax is sufficiently set, the model and mould should be immersed in water, which operation will cause the wax and the clay to separate readily, after which, if any of the clay be left anywhere, it must be carefully washed out, when the mould will be ready for casting from.

The method which will be described in the next chapter is adapted to produce what is termed a "face mould," *i.e.* one which is used for taking one surface or side only; but in such cases as producing such a piece as, say, a centre orna-

ment, where the leaves show both their front and back contours, a "back and front mould," or "double mould," is needed. This is done by making the mould in two halves.

Plaster moulds are produced by first oiling the clay model over carefully, and then surrounding it with a wall of clay. The plaster is then to be laid on (not in too soft a condition) by one piece at a time, jointing their edges in the way the workman finds most suitable and convenient. When sufficiently set, these pieces are to be removed, and when they are perfectly dry they are to be soaked in boiled linseed-oil. When the mould is well saturated with oil, and quite dry, it is ready for use. Like the wax mould, it should be oiled with sweet oil before casting from.

Other materials are used for making moulds besides wax composition, as gelatine, composition of glue and treacle, &c. (See Chapter X., "Modelling and Moulding.")

CHAPTER X.

Modelling and Moulding.

This chapter will be devoted to what may be termed the ornamental or artistic branch of working in plaster, and will comprehend brief practical instructions in moulding and casting in plaster of Paris, &c.

That species of gypsum to which, from its being found in extensive deposits at Montmartre, near Paris, we give the name of "plaster of Paris," lends itself excellently to the requirements of plastic work—whether for enrichments to be planted, centre ornaments, pateras, &c., or figures "in the round," as it is technically phrased, or in full relief, standing separately from any background.

The first step towards producing ornamental objects in plaster, of whatever size or kind, is to have a pattern or model of them. This may be something already existing, as, for example, a stone boss, or corbel end, or any other architectural ornament, of which it is permissible to take a copy in squeezing-wax (see "Squeezing-wax," in Recipes), or, as is more frequently the case, it

may be a new ornamental design, conceived and executed by some decorative artist, or by the plasterer himself. In this latter case the model is made of clay by a process known as "modelling."

Of course, there is no necessity that a plasterer who is content to confine himself to plain work all his life should learn to model. But if he have taste, and ambition to excel and rise, and especially if he has some knowledge of drawing, I should decidedly advise him to do so.

The workroom and stand.—A commencement of modelling may be made very easily and very inexpensively. It can be carried on in a spare room, kitchen, scullery, or even stable or shed, if sufficiently lighted.

A firm bench or table, standing in a good light, is a primary necessity, and into or on this a slab of stone or a large slate with a level surface should be fixed. This is better than the wooden top of the table, as it is not affected by the humidity of the damp clay. Covering the top of the bench with sheet-lead or zinc will also answer the purpose.

Better still is a movable modelling-stand, made after the pattern shown at Fig. 39. This, as is shown, has a sloping face, with a ledge at the bottom, and is strongly made of well-seasoned wood. A slate can be fixed on the slanting face. A small turn-table (Fig. 40) is a considerable improvement. This is simply a circular piece of seasoned wood, provided with a hard-wood peg in the centre, which takes into the hole in the

centre of the slope (Fig. 39). This arrangement permits of the work being turned round during its progress, and is very convenient.

The Tools.—The tools required by the modeller

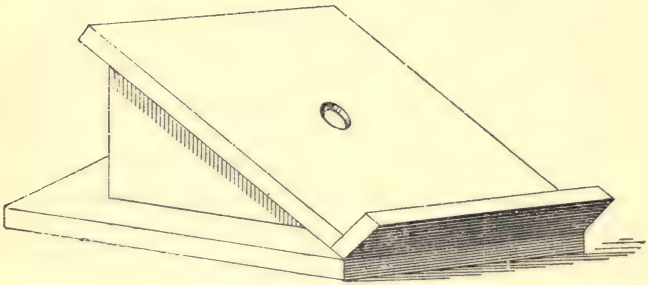


Fig. 39.—Modelling Stand.

in clay are few, and of the simplest description. They may be made of ivory, bone, box-wood, pear-tree, or any other material fairly hard, and close-grained, if wood. A selection of some of

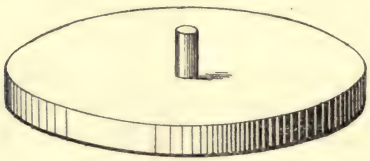


Fig. 40.

the more usual forms is shown at Figs. 41 and 42. These tools can be purchased of any artists' colourman, or may be readily fabricated by the aid of a knife and file, by the modeller himself,

from bits of some kind of hard wood. As will

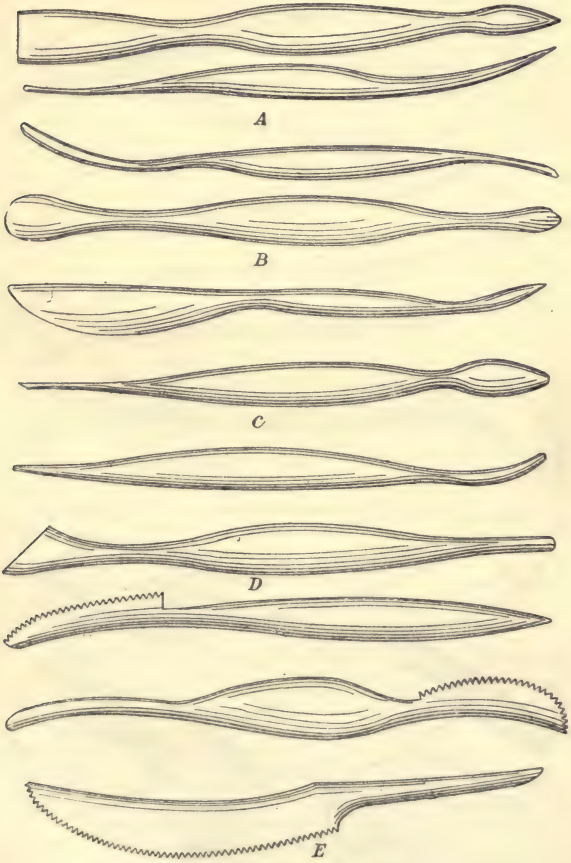


Fig. 41.—Modelling Tools.

be seen from the illustrations, they are most

usually of a spatula or spoon-shaped form, slightly

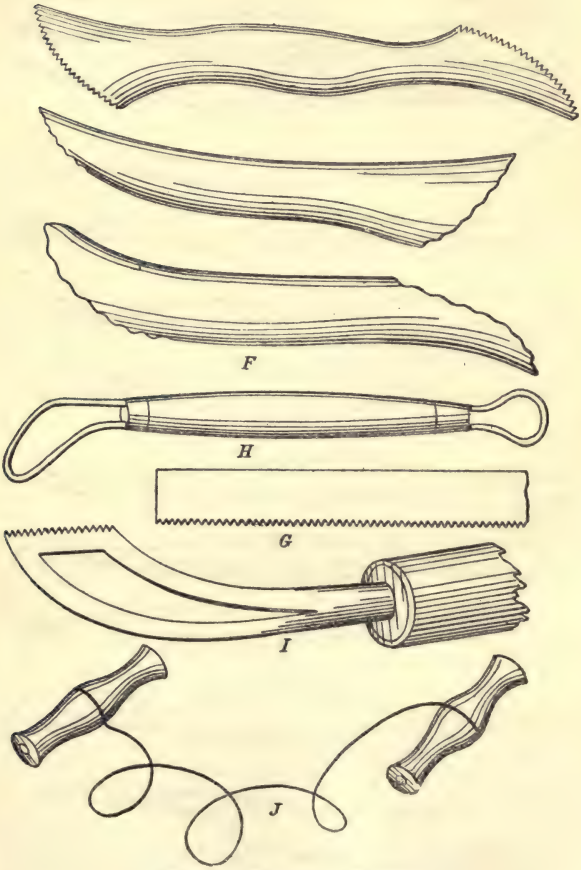


Fig. 42.—Modelling Tools.

bent at one or both ends. A, B, C, and D are of

this class; while E and F (Fig. 42) have a por-

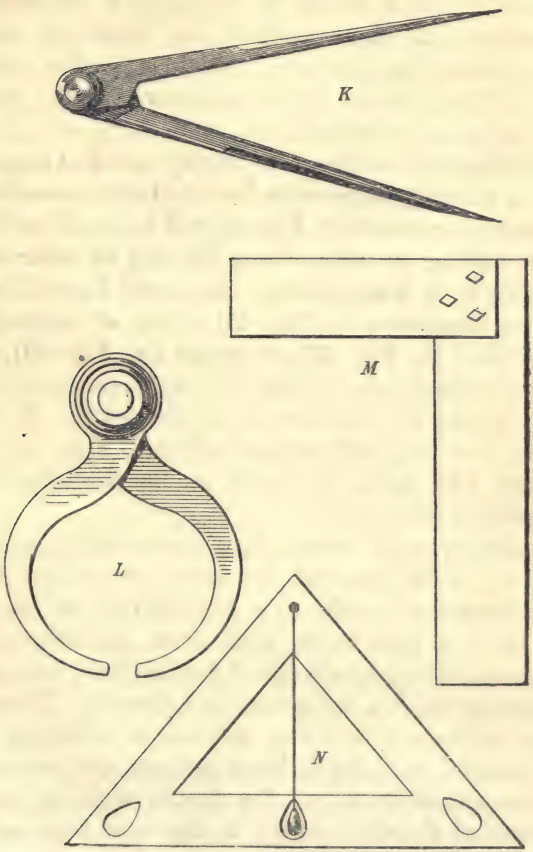


Fig. 43.—Modelling Tools.

tion of their edge serrated, or formed into teeth, like a saw, which is very useful for some pur-

poses. A straight-edge (partly shown at G), about 1 foot 6 inches in length, with one edge serrated, is also required for levelling and smoothing backgrounds. Tools with wire ends of different forms (H) are also very handy; and brass rakes, or toothed hoes, of the shape of I, and of different breadths, come in very useful at times.

A piece of copper wire furnished with a wooden handle at each end (J, Fig. 42) will be found useful for cutting up and working the clay in order to bring it to homogeneity. A pair of Lancashire wing compasses (K, Fig. 43), a pair of ordinary callipers (L, Fig. 43), a square (M, Fig. 43), a small plumb-bob (N, Fig. 43), and a coarse cloth for wiping the hands, make up the outfit. Both the pear-tree and wire-ended tools may, as I have said, easily be made by the modeller if economy be an object.

Designs.—Of course, there is necessarily something to be procured or made preparatory to forming the model—as a general rule, at least. This is a pattern to work from, sometimes a natural object, as a bunch of flowers, fruit, foliage, dead game, &c., but generally a drawing. Hence we advise any workman desirous of becoming a successful modeller to learn to draw, and practise that art assiduously. He should begin by geometrical drawing, which is the very basis and foundation of all legitimate decorative art, and then copy equally assiduously geometrical design as carried out by Nature—the great designer—in leaf and floral forms and other natural objects.

Materials.—The materials used by the modeller are clay and wax. Various kinds of clay are more or less suited to the modeller's purpose. Ordinary pottery clay, commercially termed "kaolin," is very frequently used. This is found in strata in many parts of the West of England, and can be purchased at the pits where it is dug in Devonshire and elsewhere, or obtained at most potteries, especially Messrs. Doulton's, at Lambeth. When bought in bulk, pottery clay can generally be got for about £3 per ton, or 4s. 6d. or 5s. per cwt., and if purchased in less quantities than a cwt., at 1d. per lb. It should not, however, be obtained in too small quantities, for it is very ponderous, and a cwt. does not occupy much space and does not go far.

The clay varies considerably in colour, according to the bed from which it is procured, but this is a matter of no consequence. Its quality and texture are much more important items. It should be pure clay, not mixed with marl, gravel, earth, or any other material, be free from stones and grit, tenacious, yet smooth, and capable of yielding itself to plastic influences and working freely.

If it be purchased at town potteries or from dealers at a tolerable price—say 10s. per cwt.—it ought to be in a condition fit for use, but if it be bought for, say, half that price at the pit's mouth, the operator must expect to have to temper it and bring it to a workable condition. This is effected by cutting up the clay and beat-

ing it, so as to—by the two processes—remove any foreign substances, and render the mass perfectly homogeneous.

For the first operation throw down a mass or lump of the clay on the table, and cut through it with the handled wire (J, Fig. 42), repeating this operation many times through the mass of clay in various directions. This will detect if there be any stones or grit in it, and the cut section will show whether sand, loam, &c., be mixed with it; if so, any such impurities should be carefully dug out and removed. After this the mass should be well beaten with an iron bar, and finally well kneaded with the hand, until the clay is thoroughly homogeneous, pliable, and workable, which will be when the entire mass has come to about the consistency and ductility of ordinary putty.

Some modellers add a small proportion of fine sand to their clay, especially for large or coarse work. If this be done, the sand should, of course, be thoroughly incorporated. The clay thus tempered must be kept somewhere where it is not exposed to the air, so that it may remain moist and workable; a tub, or preferably, a large glazed earthenware pan with a cover, will answer as a receptacle, and in such a vessel the clay should remain moist and soft for weeks. If it should be found to be getting dry, it requires to be broken up in water, and again kneaded up well.

Pipeclay is used by some modellers. This is,

of course, more expensive than ordinary pottery clay, and is a very good material. It may be obtained of pipe-makers and some dealers in plaster.

Wax is generally employed for small and delicate work. It consists of ordinary wax, with the admixture of some ingredients to render it softer and more pliable, and also a small proportion of colouring matter. It can be purchased of good quality of most artists' colourmen, or may be made by the following formula. Take of clear wax 200 parts; Venice turpentine, 26; lard, 13; and levigated bole Armenian, 145. Mix and knead intimately together under water.

CHAPTER XI.

Modelling and Moulding (*continued*).

Modelling practice.—The beginner had better commence practice on flat work, in not too high relief. I will suppose that he has made a very simple design of a geometrical character (say Fig. 44). Pinning this upon the wall before him, he places a lump of clay upon his modelling table, and therewith forms a foundation of suitable thickness, perfectly level and square in plan, with the corners correct right angles. The level of the surface will be secured by the application of the straight-edge, and the square will enable the correctness of the corners to be tested. Then, with the aid of one of the spoon-shaped tools, the operator commences to scrape away the clay for

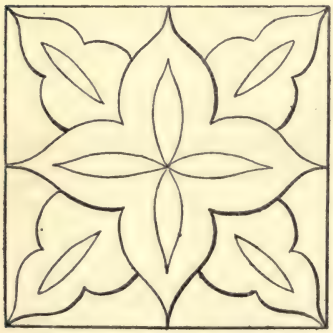


Fig. 44.—Design for Clay Modelling.

the parts which are to be depressed. It is a good practice to place a piece of thin wood on two opposite sides of the block of clay to serve somewhat as "screeds." It is then easy, by laying the straight-edge across these, to judge whether or not we are carving away the clay equally on both sides of the design. The scraping or paring away of the clay is to be conducted gradually and carefully, guarding against removing too great a quantity, and keeping the work in symmetry by the frequent application of the compasses, or, in designs of such nature as require it, the callipers.

The first efforts of the operator are not likely to be very successful. This should not, however, dishearten the tyro. Of course, modelling, even of the simplest kind, is an art to be learned, and dexterity here, as in all other things, is only attained by practice. But it may be safely affirmed that modelling is the easiest of all the arts, and the most natural to man. It has often been remarked that a child will form little effigies in clay, or other plastic material, at a much earlier age than when it can make the very roughest sketches. The operator will find, however, that his first efforts will result in but a ragged-looking production, and that the model will not very closely resemble the sketch. It will only be after some considerable amount of practice that the eye will so grasp and retain the fundamental outlines of the design as to be able to adequately control the hand in reproducing

them in the clay. It is best at first to only attempt rough work and bold effects, leaving detail and the production of ornamental minutiæ until some considerable experience has been attained.

The fundamental point of artist practice to bear in mind is, that all effects are best obtained —at least at first—by cutting away or removing clay, and not by building up or adding it. Of course, some more material can be added if required for the relief, but unless the added portion be of exactly the same consistence as the main body of the work, and be also very carefully affixed, the portion so attached may dry unequally, as the work dries, and become detached or drop off.

I have here spoken of working from the paper sketch by the eye alone.

Another method is to sketch the outlines of a design with a crayon or black-lead pencil on the modelling board. Bits of clay can then be taken, moulded by the hand into small rolls and affixed to the board, holding the strips of clay in the left hand and pressing them down on the lines with the fingers of the right. The material must be pressed down with care, so as to exclude any air from remaining below it, and to secure its thorough adhesion to the board. The end of either of the chisel-ended tools (A and D, Fig. 41) may be used to keep the clay within the boundary lines of the design; but the fingers are, after all, the best modelling tools, as all successful modellers have testified. The whole of what may be termed the

"ground-plan" of the design should be laid down on the board before any building up of the relief is attempted. In performing the latter, when a bit of fresh clay is added, it is absolutely requisite that the surfaces to be joined should be somewhat softer, that is more moist, than the bulk of the work. Here the sponge comes in usefully.

Fig. 45.—Floral Patera.

When a due amount of clay for the proper relief has been built up, the various lines of the details can be obtained by pressure with one of the modelling tools, properly manipulated.

Fig. 45 is a patera (or circular design) of simple botanical *motifs*, well adapted for early practice. The three leaves forming the triangular

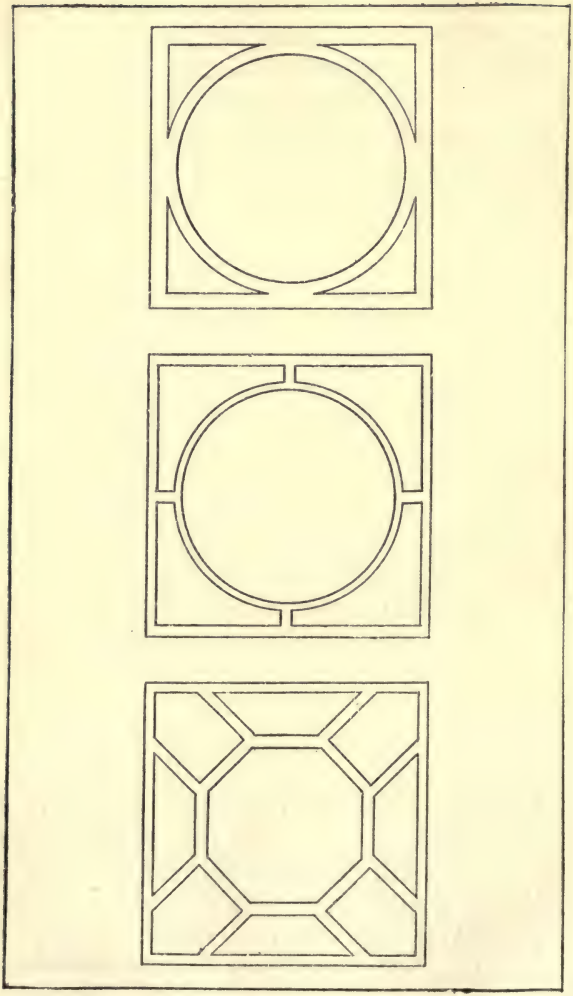
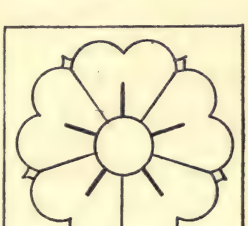


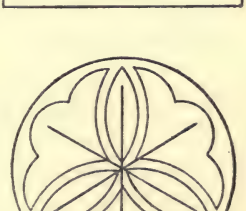
Fig. 45.—Patterns.

centre should be in higher relief, or more elevated than the surrounding blossoms.

As a general rule the centre of a circular design—indeed, to a certain degree in most designs—should be higher than the sides.



The next two illustrations (Figs. 46 and 47) contain a selection of simple patterns for practice.



To the world of nature the designer can always turn with the full assurance that it will abundantly reward his attention.

As simple examples I would adduce Fig. 48, a little border of wild bineweed (*Convolvulus arvensis*).*

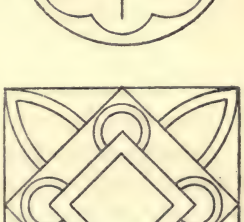


Fig. 47.—Patterns.

Almost everything that grows can be pressed into the service of the designer — the wayside

* For six of these designs I am indebted to a treatise entitled "A Village Class in Drawing and Wood-Carving," by Gertrude Martineau, published by Messrs. Longmans, Green & Co., a most useful and very cheap little book which I decidedly advise every embryo-modeller to acquire. Fig. 46 is from Gwilt's "Encyclopædia of Architecture."

weeds that grow beside his path in a country walk, the leaves of the trees which overarch his head, the blossoms and foliage of the shrubs that grow in his garden, or the plants which adorn his window-sill.

Modelling in wax is conducted in precisely a similar manner to that in clay. It is best adapted for small work and delicate detail.

Of course the main utility to the practical plasterer of modelled and cast work is in the opportunity which it affords him of obtaining enrichments in cornices and other mouldings, and for

Fig. 48 —Border Design.

relief ornaments for "planting" in or affixing to ceilings of a decorative character.

Examples of what are termed "enrichments" may be sought out in elaborate works on decorative art, or invented by the workman himself. Not much is done now in relief work for decorated ceilings, although at any time the fashion for them might be revived, and then the plasterer would need to know something about this kind of decoration.

The decoration of ceilings with plaster designs in relief was a fashion set by the Italians, and

which had immense vogue or popularity in this country rather more than a century ago, when the celebrated brothers Adam produced many designs well adapted for this purpose.

In many quarters of the metropolis, where streets of good houses—now much fallen from their palmy estate—were erected during the reign of "good Queen Anne" (about Soho and Bloomsbury, for example), we may frequently come upon beautiful examples of ornamented ceilings of this kind, which prove beyond the possibility of a doubt that the English plasterer of that epoch was not only an artisan, but an *artist* also. Would that we could say the same to-day!

Moulding.—Having modelled our ornamental conception or design in clay, we desire to reproduce it in plaster of Paris, and the first step thereto is to obtain a mould of it.

There are three ways of doing this. The mould may be formed itself of plaster, or of moulding wax, or lastly—for work much under-cut—of some elastic substance or composition.

Plaster moulding and casting.—The clay model is first carefully looked over, and any lines which are not perfectly clear and clean picked out with a picker or small sharp awl or point. Then, when the model is perfectly dry, it is well brushed over with oil. Some good plaster of Paris mixed with a small portion of red ochre is then gauged to about the consistency of pudding batter, It is to be noted that I have specified "good"

plaster. That means fresh plaster made from sound gypsum. It should have a sweet, healthy odour, and set crisp and hard in from ten to twenty minutes after mixing. Inferior plaster has a smell like brimstone, and never sets firmly. The plaster is best gauged in a big basin or other suitable vessel half full of cold water. Into this the plaster is gradually sprinkled by the left hand, while the right keeps the mixture stirred with a metal spoon until the proper consistency is obtained. The clay model is then at once completely covered with a layer of the plaster, which can be thrown on with the spoon, the operator taking especial care that it goes under any "under-cut" portion, as, for instance, the projecting points of a leaf. Care should be taken that no air-bubbles are enclosed. If the model is a large one it is best to have several mixings of the plaster, as the latter is useless when it commences to set. Some moulders perform this operation by placing the clay model upright and dashing the plaster upon the face of it; but most beginners would probably prefer to do it with the model lying down.

When this coat of coloured plaster is set quite hard, it is to be washed over with clay-water, made by dissolving some clay by well stirring it in water. This is applied to the back of the clay with a soft brush, and is used to facilitate the breaking-up and removal of the mould after casting. Some more plaster is then mixed for the "backing," and a commoner grade of stuff may

be employed for this. This is applied all over the back of the coloured coat in a stratum of less or greater thickness, according to the size of the work. If this be very large a few strips of $\frac{1}{4}$-inch iron nail rod had better be embedded in the back to strengthen it and counteract any tendency to warping.

When the mould has set perfectly hard, the work is to be turned over and the clay model broken up and carefully picked out, taking care not to injure the mould in the process.

If the model has been built upon a board or a slate it is sometimes rather difficult to accomplish the separation of this from the moulded model. The blade of a long thin knife judiciously used and supplemented by a piece of wire will, however, with a little patience, be effective.

For small or delicate models it is best to mould in wax. This is effected by melting $\frac{1}{2}$ lb. of beeswax, $\frac{1}{2}$ lb. of black resin, and 6 oz. of tallow together. The model has a border wall of clay built around it, or some small strips of thin wood, the top of either being elevated somewhat above the highest part of the model.

The casting-wax is then poured on hot, and when cold the clay is carefully picked, and, if necessary, washed out.

For elastic moulds, one part of good glue and two parts of molasses (treacle), by weight, are melted together in a large glue-pot, or other water bath, and poured over the model after the latter has been prepared in a similar manner to that just

described for wax moulds. When the elastic compo has been poured over the mould a piece of coarse canvas should at once be laid on the top of it, and a bit of thin board on this, to keep it down on the mould. When the compo has quite set, it can be carefully lifted, and will strip off the model without difficulty, and without the latter being destroyed.

Casting.—The casting in plaster is somewhat differently carried out according to the material of which the mould has been made, *i.e.*, whether it is a plaster, wax, or compo (elastic) one.

A plaster mould should have its surface first well washed with water and a soft brush to remove any possible dust left from the clay model. The mould is then placed in a vessel of water until thoroughly soaked, and next taken out and drained, but not wiped. No *drops* of moisture, however, must be seen on the surface.

Enough plaster of the best quality carefully gauged is then poured in, and the mould is carefully moved about so that the plaster equally covers its superfices in every part. This surface coat is next backed with coarser plaster, strengthened, if it be necessary, with iron rods (varnished or painted) embedded in it if the work requires such reinforcement to impart sufficient solidity.

When the casting has set perfectly hard, what is termed the "knocking out" is performed. This consists of the removal of the mould from the cast, and this is often a task of considerable difficulty.

The outer coarse backing of the mould can usually be struck off with a mallet and a carpenter's chisel, as the wash of clay-water that was given permits the coarser coat to break away easily.

The cast may then be laid down upon a folded blanket or piece of sacking on the table or bench, and the coloured plaster of the inner coat removed. This is best done by placing the edge of a firmer chisel on the plaster, holding the handle upright and giving the end of it a very gentle tap with the mallet. By this means, exercised very cautiously, the coloured plaster which forms the face of the mould can be gradually broken away in larger or smaller bits until it is all removed from the cast. The mould being coloured with the ochre and the cast being of white plaster, the operator will be able to readily distinguish between them, so as not to injure his cast. A broad chisel may be used for detaching the backing, but for removing the coloured face of the mould, a $\frac{1}{4}$-inch one or even less will be most safe, or a stereotyper's "picker" will come in useful.

In casting in a wax mould the plaster is gauged and poured in in the same manner as described for plaster. After the work has set, the wax mould is held before a fire until it softens, when it can be stripped off readily, and subsequently remelted and used again for another job.

Compo moulds can be similarly cast from, but should be well greased before pouring the plaster in.

Waterproofing plaster casts.—In consequence of a prize having been offered by the Prussian Minister of Commerce and Industry for a method of preparing plaster casts that would permit of their being washed, Dr. W. Reissig, of Darmstadt, devised two plans which are thus described in his essay on the subject:—

Experiment shows that in order to render plaster casts washable while preserving the due sharpness of outline, it is necessary to convert the lime sulphate into either (1) baryta sulphate and caustic or carbonate of lime or into (2) lime silicate, by means of potash silicate.

1. The process conducted with baryta-water is the simplest, easiest, and cheapest method. It depends upon the fact that gypsum, or lime sulphate, is converted by baryta water into baryta sulphate (which is totally insoluble), and caustic lime, which latter is converted by contact with the air into lime carbonate.

The practical method of carrying this out is as follows:—A large zinc vessel is required with a tight-fitting cover; in each vessel is a grating made of strips of zinc, resting on feet $1\frac{1}{4}$ inches high. This vessel is two-thirds filled with soft water at 54° to 77° F. (12° to 25° C.), and to every 25 gallons of water is added 8 lbs. fused or 14 lbs. crystallised pure hydrated barium oxide, also 0·6 lb. lime, previously slaked in water. The solution stands about 4° Beck (1·0241 sp. gr.). As soon as the baryta water gets clear it is ready to receive the casts. They are wrapped in suit-

able places with cords, and, after removing the scum from the baryta bath, are dipped in as rapidly as possible, face first, and then allowed to rest upon the grating.

Hollow casts are first saturated by rapid motions, then filled with the solution, and suspended in the bath with the open part upwards. After the cords are all secured above the surface of the liquid the zinc vessel is covered. The casts are left in it for one to ten or more days, according to the thickness of the waterproof stratum required. After taking off the cover and removing the scum, the plaster casts are drawn up by the strings, rinsed off with lime-water, allowed to drain, carefully wiped with white cotton or linen rags, and left to dry, without being touched by the hands, in a warm place, free from dust. The same solution which has been once used can be employed again by adding a little more baryta and lime.

2.—The following is the process for hardening with the silicate of potash solution. This depends on the conversion of the lime sulphate into lime silicate, an extremely hard, durable, insoluble compound, and is accomplished by the use of a dilute solution of potash silicate containing free potash. To prepare this solution first make a 10 per cent. solution of caustic potash in water, heat to boiling in a suitable vessel, and then add pure silicic acid (free from iron) as long as it continues to dissolve. On standing the cold solution usually throws down some highly-sili-

cated potash and alumina. It is left in well-stoppered glass vessels to settle. Just before using it is well to throw in a few bits of pure potash, or to add 1 or 2 per cent. of the potash solution. If the plaster articles are very bulky, this solution can be diluted to half with pure water.

The casts are silicated by dipping them (cold) for a few minutes into the solution, or applying the solution by means of a well-cleaned sponge, or throwing it upon them as a fine spray. When the chemical reaction, which takes place almost instantly, is finished, the excess of the solution is best removed with some warm soap-water or a warm solution of stearine soap, and this finally removed with still warmer pure water.

The casts, which can be immersed or easily moved around, may be treated as above when warm; a very short time is required, but some experience is necessary. In every case it is easy to tell when the change is effected from the smooth, dense appearance, and by their feeling when scratched with the finger-nail. It is not advisable to leave them too long in the potash solution, as it may injure them. A little practice renders it easy to hit the right point. The fresher and purer the gypsum and the more porous the cast, the more necessary it is to work fast. Castings made with old and poor plaster of Paris are useless for silicating.

In washing these washable plaster casts a clean sponge should be used, carefully freed from all

adherent sand and limestone, not with lukewarm water, and well soaped. They are afterwards washed with clean water. They cannot, of course, be washed until thoroughly dry, and saturated with carbonic acid from the atmosphere. The addition of some oil of turpentine to the soap is useful, as it bleaches the casts on standing. The use of hot soap-suds must be avoided.

CHAPTER XII.

Stucco.

Lath and plastered edifices can boast a high antiquity, but our early ancestors were not acquainted with the practice of "rendering" brickwork, and when building in brick came in with the early Tudors it was highly esteemed, and no one would have thought of concealing the brickwork with plaster. Plain brick building maintained its popularity to the end of the seventeenth century. Meanwhile the superior species of plaster invented by the Italians, and known by them as "stucco," had been introduced into this country for internal work. The adoption of stucco externally as a coating which should give to brick houses the appearance of stone is due to the Brothers Adam, the celebrated architects and decorators—or rather to Robert Adam—and their use of it caused it to come into general requisition.

It was found that "stucco" in able hands permitted the production of very stately looking buildings at a very reasonable cost, and especially that its plastic nature enabled it to adapt itself freely to very considerable decorative or ornamental effects.

But the lapse of a few years effected fresh

changes. Experience proved that although it might look well and attractive while new, stucco was not durable, especially if, as was often the case, proper care had not been taken in the selection of the ingredients of which it was composed. It was found that the weather speedily acted detrimentally upon stucco, and disintegrated it, and that it had in consequence an evil habit of falling off in patches. So in towns Portland cement began to be substituted for it; and, still later, the great improvement in brick architecture by the free employment of moulded terra-cotta and of freestone members has almost driven it out of the field, so much so, indeed, that "stucco" has become a synonym for a sham, and its real usefulness for certain objects and in certain places has been foolishly denied.

The Italian term "stucco" is usually applied in that country to a superior species of external plastering intended to imitate stone or simulate marble. It is therefore necessary that this species of plaster shall be of good quality and capable of yielding speedily a solid surface, one so good, in fact, that if required it may be polished finely to give the appearance of real marble.

The Italians, from whom we get both the name and the idea of stucco (see Chapter on "Sgraffito"), use plaster of different qualities for the various coats which they lay on. They first apply a coat of coarse material, analogous to our "rendering." Then they lay on a second coat, which contains a larger proportion of lime than

the first and produces a close, fine-grained surface. The stucco for the finishing coat is, however, a very superior description of plaster. It is composed of rich lime, slaked and sifted through a fine-meshed sieve. It is considered best that this stucco should be permitted to lie for five or six months after mixing before it is used. Where this is, however, impracticable the perfect slaking can be accelerated by beating the mixture very often.

Where a very superior stucco is required the dust of powdered Carrara marble, or other white marble, is often added, and this mixture is substantially that recommended by Vitruvius, and used by the ancient Romans, and which was revived at the epoch of the Renaissance, as described in Chapter I. Alabaster or gypsum (sulphate of lime), in a powdered state, is sometimes also mixed with the plaster in place of the marble dust, but the plaster is then only suited for use in situations not exposed to the weather. Where marble dust is used the lime is gauged with a considerable quantity of water so as to bring the mixture to about the consistence of very thin paste, then the marble dust is added, in quantity about equal to the lime, and the whole is mixed in small quantities until perfect amalgamation has ensued. This third and final coat of stucco should be well and carefully trowelled, so as to present a perfectly level and smooth surface.

This finer final coat will, if properly made and applied, present a plaster surface little inferior to ordinary white marble. Colour can be imparted

to this stucco by mixing certain metallic oxides and earths with it. (See Chapter XIV., "Scagliola.")

Speaking generally, modern stucco in this country varies considerably according to the species of binding substance selected as the matrix. Either hydraulic cement, Roman cement, or Portland cement is generally used, clean fine sand being adopted as the aggregate. For the earlier coat either of the substances is gauged with from two to three parts of it to one of lime, Roman cement, or Portland cement. The latter, as I have just remarked, has pretty much superseded the former two. The lighter grades of Portland are mostly used for stucco, and each coat is laid on before the preceding one is dry, the brickwork being well wetted before the "rendering" is applied, and the surface of each coat being left rough to afford a key for the succeeding ones. The finishing coat may consist of neat cement, or cement and sand in equal proportions. If the mixture be too rich it is apt to crack in drying, but careful trowelling will do much to obviate this.

When stucco is composed of plaster of Paris instead of lime lukewarm size-water is very generally employed for gauging it. This is usually made by dissolving some fish-glue or gum Arabic in the water, so as to cause the mixture to be more homogeneous and avoid porosity of surface, thus, in cases where the stucco is subsequently polished, enabling a superior degree of gloss to be obtained.

This latter process must not be attempted until the whole surface of the stucco is perfectly dry and hard. It may then be carefully rubbed over with a piece of very fine-grained limestone and water, washing the surface off with a sponge at intervals. Afterwards it is well to go over the surface again with a smooth-faced "bat" of snakestone or "Water-of-Ayr"* stone and water, whereby a very fine polish is secured. The stucco is finally finished off by friction with a rubber of stout felt dipped in fine Tripoli powder and oil, followed by a light rubbing with a felt charged with oil only.

The plaster stucco is well adapted for fine ornamental interior work. Some of the cements (especially "Adamant" for fine work) are excellently adapted for compounding stucco. (See Chapter III., "Materials.")

The following may be taken as an ordinary example of a specification of plasterer's work in a private dwelling-house, whose exterior is to be stuccoed.

External work.—Compo the whole of the outer walls, and run the cornices, string-courses, mouldings, &c., generally with blue lias lime of approved quality, mixed with clean sharp river sand, in the proportion of two parts sand and one part lime; care to be taken that all arrises, mitres, mouldings, quirks, angles, &c., are to be cut clean, sharp, and true, and the several enrichments cast clean, and fixed firmly and accurately.

* "Water-of-Ayr stone" (or "snakestone"), now known as "Tam o' Shanter stone," is a very fine hone-stone.

Provide and fit accurately eighteen cast cement balusters, and six half ditto.

Provide and fix two ornamental trusses to doorway, 24 in. deep.

Internal work.—The lime to be used for internal work to be the best chalk lime, to be run through a fine sieve, mixed with clean sharp grit sand and strong cow-hair, well gauged and tempered, prepared a proper time before using, and every precaution to be taken to prevent cracking or blistering. The laths to be sound and of good quality, not lapped at the joints, laid in bays, and secured by good nails.

The ceilings of basement to be lathed with strong laths, securely nailed, plastered two coats, set fair, and whitewashed twice when dry.

The ceilings to ground and first floors and soffits of stairs to be lathed, plastered, floated, set fair, and twice whitewashed. The walls on ground floor to be rendered two coats and set fair for papering. Run all the external angles with approved cement, free from admixture with lime, plaster, animal matter, or other material whatsoever. Run round the ceiling of drawing and dining-room a cornice 1 ft. 8 in. girt, to have an enriched soffit 5 in. wide.

Provide and fix in both rooms a centre flower ornament 2 ft. in diameter. Run round ceiling of morning-room a cornice 18 in. girt. Run a cornice in all bedrooms in main building 8 in. girt. Run to hall and staircase a cornice 8 in. girt.

CHAPTER XIII.

Decorated Ceilings.

The ceiling of a large room, offering as it does a wide expanse of space, has been always held to be a promising field for the display of the skill of the ornamentist. Thus the fresco painters of the Renaissance eagerly appropriated the ceiling as a fine surface for the exercise of pictorial art, as may be seen on those of Buckingham Palace, Windsor Castle, Hampton Court, and many of the mansions of our nobility, and in many of the palaces and palatial residences of the Continent.

The decorative plasterer, also, has not been slow to show that his art is not behind that of the painter in relieving the monotony of the extensive flat surfaces presented by the ceilings of large and important rooms; and we find ornaments moulded in "gesso" or cast in plaster achieved by the plasterer as the legitimate decorative successor of the earlier wood-carver who produced the elaborate oaken *plafonds* of the Mediæval period. Both the Italians and the French produced excellent work of this character, but we have little notable English work until the latter part of the eighteenth century. It is true

some fairly good decorated ceilings of the period of the Orange sovereign and the early Georgian epoch are still extant; and about Soho and Bloomsbury, in the principal apartments of residences which were mansions of note in the heyday of their being, but have now "fallen from their high estate" and become lodging-houses, offices, or manufactories, may be frequently discovered, hidden under a thick coat of dust and grime, some very superior modelled plaster work.

But it is to the Brothers Adam, or rather to Robert Adam (1768—1820), that England owes her most effective designs for ornamental plaster work. These eminent brothers—the architects of Exeter Hall—were decorators as well as architects, and were, indeed, more celebrated in the former capacity than in the latter. The brothers' style of ornamentation was pretty much in that pseudo-classic late Renaissance style of the Louis Quinze epoch, which also perhaps properly coming under the designation of *rococo*, possessed nevertheless the one important and patent characteristic of grace—a charm which redeems many faults and shortcomings.

The ceilings, panels, medallions, &c., of the Adams were novel, and in the highest degree elegant and graceful. In this respect they nearly approach the best domestic decorators of the French *setto-cento* (1600—1700 A.D.), and if we miss the grandiose vigour of Lepantre and Le Brun, we have at least something akin to the

delicacy of those designers to whom Europe owes the Trianon.

Those who would form some adequate conception of the versatility and fecundity of the Brothers Adam, should inspect the wonderful collection of their drawings at the Soane Museum, London. Some of Robert Adam's best productions are published in volume form, splendidly engraved, complete collections being very valuable, and not only of historic interest, but of practical technical value, the style which they represent being one which still has a strong hold on public favour.

The "Works in Architecture" of Robert and James Adam, 1778-1822, have been published in three folio volumes full of copperplates and with the text both in French and English. This is now a very scarce and valuable book, rarely to be met with; but Mr. Batsford, of Holborn, published, a year or two since, reproductions of many of the designs by photo-lithography in a thin folio volume, which is very useful for decorative artists of many crafts.

The Adams' designs are far too elaborate for reproduction in my small page, but I give some examples of good ordinary decorative ceilings.

Fig. 49 is a half design for a decorated ceiling of light and graceful style, and Fig. 50 represents a quarter of an effective scheme of ornament for the ceiling of a large chamber.

In the preparation of an ornamented plaster ceiling, there are sundry processes to be metho-

dically carried out. In the first place either the architect or the plasterer himself must draw a

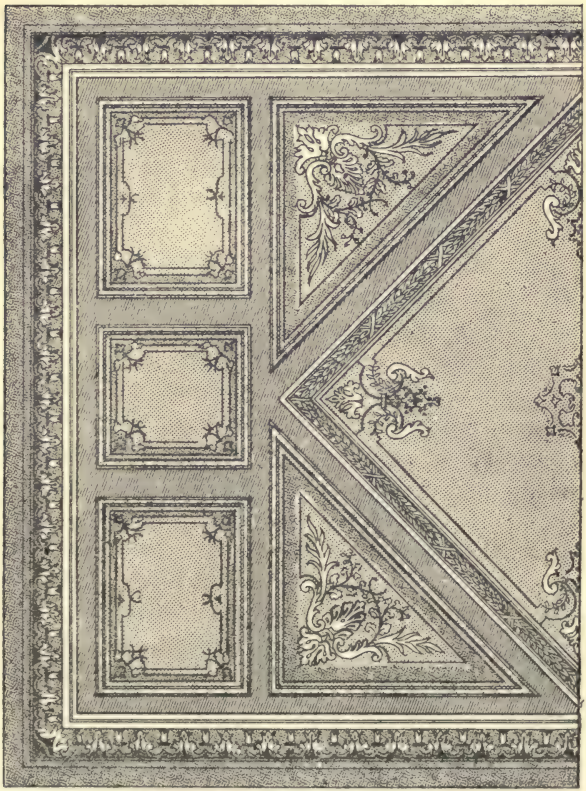


Fig. 49.—Half Ceiling.

general design, to scale, of the entire surface of the ceiling, and the whole scheme of decoration

which is to adorn it. Of course all plaster ornaments for this purpose consist of members in greater or less relief, planted or fixed in the smooth surface of the plaster coat itself. Generally speaking these consist of ribs, more or less decorated, which divide the surface of the ceiling into rectangular spaces, or spaces of other regular figure. These are doubtless a survival of memories of the early roofs of more primitive times, when the actual timbers of a roof framing were visible between the plaster.

"Ceilings," remarks Mr. Gwilt, "are either flat, coved—that is, rising from the walls with a curve—or vaulted. They are sometimes, however, contours, in which one, more, or all of these forms, find employment. When a coved ceiling is used, the height of the cove is rarely less than one-fifth, and not more than one-third the height of the room. This will be mainly dependent on the real height of the room, for if that be low in proportion to its width, the cove must be kept down; when otherwise, it is advantageous to throw height into the cove, which will make the excess of height less apparent."

It is, however, mainly of flat decorated ceilings that I would here speak, and these being as a rule parallelogrammatic in plan are usually divided by ribs, mostly running from side to side and intersecting at the point of meeting. At such intersections it is sometimes usual to fix small ornamental bosses or pendants.

As I have said, the first thing is to prepare a

general design of the ceiling. If this ceiling be flat and of the shape of a parallelogram, the

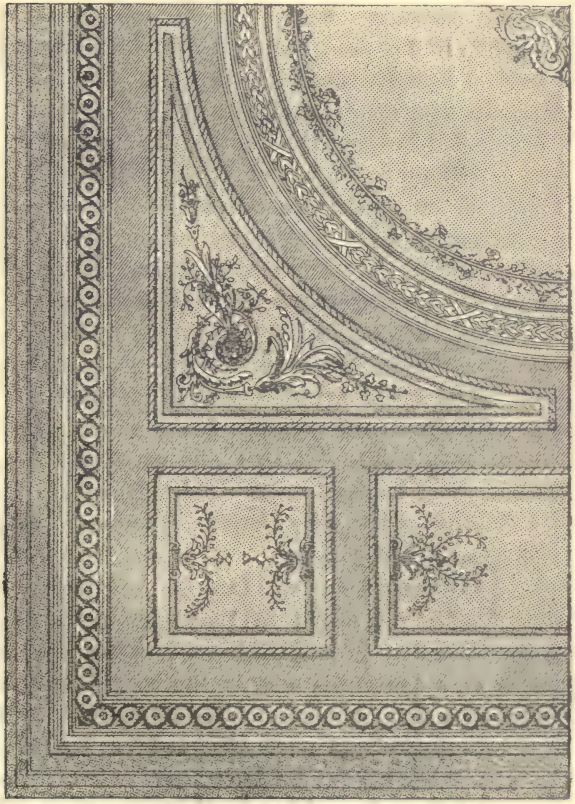


Fig. 50.—Quarter Ceiling.

central part is usually formed into a large flat panel, which is commonly decorated with a flower

in the middle. Of course if the decorator have himself to make the design he must have had at least some previous training in the art of designing and drawing. Next, from the plan, working drawings of full size should be made of all ribs, rosettes, bosses, pendants, flowers, &c. From these drawings these various parts will require to be modelled in clay; these models being moulded and cast from, in plaster of Paris, in the manner described in my chapter devoted to that subject. In plastering the ceiling, recesses are formed for the reception of the various ornamental parts, which are fixed therein by the aid of some plaster of Paris. Sometimes it is requisite to fix wood "grounds," and for very heavy flowers, centres, and other large ornaments, screws must pass through them and into the joists above. It is needless to point out that all ornaments of a ceiling must be firmly and stably affixed, so that no shaking of the floor boards above by dancing, &c., shall dislodge them.

"As to the proportion of the cornice," observes Mr. Gwilt, "it ought in rooms to be perhaps rather less than in halls, saloons, and the exterior parts of a building; and if the entablature be taken at a fifth instead of one-fourth the height, and a proportional part of that fifth be taken for the cornice, it cannot be too heavy. . . Chambers, if followed, would make the proportions still lighter than I have set them down. He says that if the rooms are adorned with an entire order, the entablature should not be more than a sixth

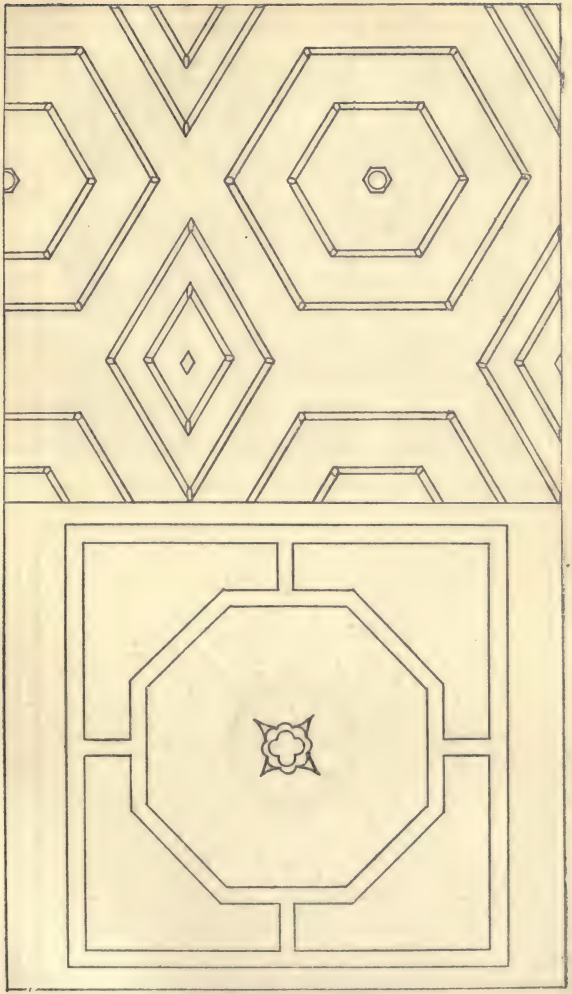


Fig. 51.

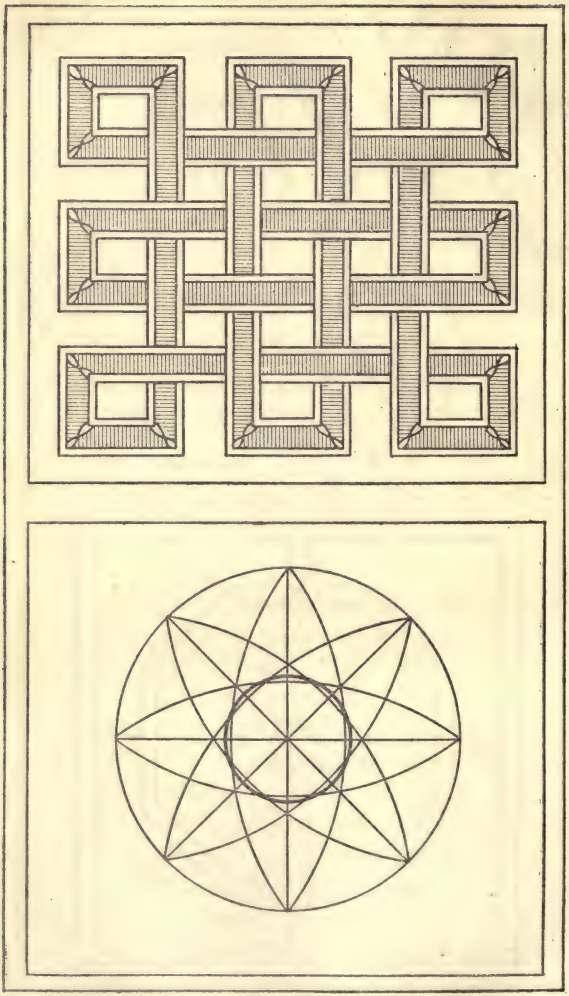


Fig. 52.

of the height, nor be less than a seventh in flat-ceiled rooms, and one-sixth or one-seventh in such as are coved; and that where there are neither columns nor pilasters in the decoration, but an entablature alone, its height should not be above one-seventh or eighth of these heights. He further says that in rooms finished with a simple cornice it should not exceed one-fifteenth nor be less than one-twentieth, and if the whole entablature be used its height should not be more than one-eighth the uprights of the room."

Figs. 51 and 52 show some simple schemes of ornamentation which may serve as hints to the reader.

CHAPTER XIV.

Scagliola.

The making of Scagliola, or artificial marble, is a distinct branch of plastering, discovered or invented in Italy, where it had been much used, and thence introduced into France, where, having fascinated all the *cognoscenti*, it obtained the title of "Scagliola." Mr. Henry Holland, who first brought it to England, engaged the artists from Paris to execute it, some of whom, finding a demand here for their labour, remained in the country and instructed our own workmen in the art.

Columns and pilasters (for which scagliola is generally used) are executed in this branch of plastering in the following manner. A wooden cradle, composed of thin strips of deal or other wood, is made to represent the kind of column designed, but about 2½ inches less in diameter than the shaft is intended to be when finished. This cradle is lathed round, as for common plastering, and then covered with a pricking-up coat of lime and hair. When this is quite dry the scagliola workers commence their operations.

I will next describe the method of procedure

adopted by the French craftsmen who have been referred to, and who were such excellent masters of the process that it would be well-nigh impossible to improve upon their manner of working. Indeed, by an imitation of the most rare and precious marbles, it was generally conceded that they produced a most astonishing and delusive effect; for nothing short of actual fracture of the work executed could discover the counterfeit, any stone partaking of the character of marble being most closely and even exactly imitated in scagliola, the imitation taking quite as high a polish as the original marble.

The workmen select the purest gypsum (alabaster, carbonate limestone) they can obtain, which, after breaking into small pieces, they calcine. As soon as the largest fragments lose their brilliancy the fire is withdrawn, the calcined powder is passed through a very fine sieve, and mixed up as it is to be used with a solution of Flanders glue, isinglass, &c. In this solution the colours required in the marble to be imitated are also diffused; but when the work is to be of various colours, each colour is separately prepared, and they are afterwards mingled and combined, nearly in the same manner that a painter mixes the primitive colours on his palette, to compose his different tints.

When the powdered gypsum is prepared and mixed for the work, the plasterer applies it on the shaft of the columns or pilasters, &c., over the pricked-up coat of lime and hair, and then

the surface is floated with wooden moulds made of the requisite size, the craftsmen using the species of tinted plaster necessary to the imitation of the special marble as he proceeds with the floating, by which means they become mingled and amalgamated, as it were, during the process.

Instead of lathing as a basis, wire netting, or still better, "expanded metal," is well suited for the column work (Fig. 14, p. 60).

The colours used must of course be of a durable kind, and such as will remain unaffected by air, sunshine, &c. The mineral ochres and colours used by fresco painters are suitable.

To impart to the work the requisite polish, or glossy lustre, so much admired in marble itself, the plasterer rubs it when set with a piece of pumice-stone, held in one hand, while in the other he holds a wet sponge to clean the surface with. A good rubbing, upwards and downwards, with a piece of snakestone (or Water-of-Ayr stone), while the surface is kept well wetted, may fitly follow this. The operator then polishes the column with Tripoli and charcoal, and a piece of fine soft linen, and after going over it with a piece of felt dipped in a mixture of oil and fine Tripoli, he finishes the process by the application of pure oil.

For the imitation of real marble by scagliola, I take the following description of forming "Pilasters, &c., in scagliola," from a small book by Mr. F. Reinel. It is pretty clear that he also had previously transcribed it (probably from

some old book of trade recipes). It is evidently incomplete, as it speaks of taking the "composition" out of the "trough"; but omits to state of what the "composition" consists, or what kind of a "trough" is meant. It reads as follows:—"When the architect has finished the drawing exhibiting the diameter of the shaft, a cradle is made of wood about $2\frac{1}{2}$ inches less in diameter than the projected column. The circumference of this cradle being lathed with double laths, as in common plastering, must be covered with a pricking-up coat of plaster, gauged with very thin size to harden it.

"The pricking-up coat, after being completely set, must be well soaked with water. The composition must then be taken from the trough, flattened into cakes about eight inches square, applied to the column, and well beaten on with a wooden beater and a small gauging trowel. In this state it must remain until perfectly dry, when the protuberances may be taken off with a plane. The column must then be put into the lathe and turned to the size required. This operation being finished, it will have a porous appearance, which must be obviated by the application of a thick wash, and scraping it with steel scrapers until it assumes the appearance of real marble, when it will be fit for polishing, which must be effected by first using pumice-stone, at the same time cleansing it with a wet sponge, and afterwards with Tripoli powder and charcoal. After going over the whole with a

piece of white glove leather, dipped in a mixture of Tripoli powder and oil of olives, the process must be finished by the application of pure oil. White scagliola is simply a mixture of plaster of Paris and mineral green, the method of using it being the same as above described." *

* "The Mason's, Bricklayer's, Plasterer's, and Slater's Assistant." By F. Reinel. London: Brodie and Middleton.

CHAPTER XV.

Stucco Duro and Gesso.

I have included these two varieties of plaster work in one chapter and under one heading, partly because they may be fairly held to have something in common, but principally because they are both foreign methods, which originated at the same time and place, namely, in Italy, during what is ordinarily known as the Early Renaissance period.

Stucco duro, or "hard stucco," as the Italian phrase signifies, is a very ancient material for decorative work, being known to and employed by the ancient Romans, and even probably by the Greeks at a still earlier period.

Some remains of antique work of this character are occasionally discovered, as, for example, the delicate *bassi-relievi* ("low relief") plaques in stucco disinterred some few years since from a site near the Villa Farnesina at Rome, or the ruder examples taken from some Italo-Greek tombs. Both these can be inspected at the South Kensington Museum.

We know something of this early variety of hard stucco from a very ancient work—the ear-

liest book on building extant—the "Architecture of Marcus Vitruvius Pollo," * ordinarily known as "Vitruvius." The stucco was composed of well-burned slaked lime, fine sand, and finely-ground unburned limestone or white marble dust. These ingredients were gauged with water, and thoroughly amalgamated by the compound being well beaten with sticks until it became really homogeneous and quite plastic. The Latin writer advises that the broken fragments of marble should be passed through three sieves of varying fineness of mesh, and that the stucco prepared with the coarser portion should be used first for roughing over the parts of the design intended to present the boldest relief, to be followed by the next in coarseness, for the general and average modelling, and that the finest should be reserved for the superficial finish, as yielding, when properly dealt with, a surface as smooth as polished marble. Additional fineness of surface could be secured by polishing the work with chalk and powdered lime, and a comment on the extreme shininess thus obtained is furnished by Vitruvius's assertion that such work would reflect the human face like a metallic mirror, such as was used by the Roman ladies.

With the fall of the Roman empire under the assaults of the barbarians the making and working in stucco duro became a lost art. Many centuries afterwards it was revived, and its re-

* The "Architecture of Marcus Vitruvius Pollo." Translated by Joseph Gwilt, F.S.A. Crosby Lockwood & Son.

vival, during the period of the Renaissance, forms one of those romantic episodes with which the history of art is so replete.

In the Rome of the sixteenth century, when the Medici Pope Leo X. sat in the chair of St. Peter, the baths of the Emperor Titus were disinterred. Of course all the seven-hilled city held of artists and men of culture were present at that interesting exhumation of ancient architecture. Amongst these were Raphael Sanzio, the great painter, and Giovanni da Udine. Both were extremely impressed with the great beauty of the ancient stucco work thus discovered, and realised its potential usefulness in surface decoration. The result was a series of experiments, culminating in the discovery of a practicable stucco duro. This composition was first used and with the best effects in the decoration of the Loggie of the Vatican.

The innate capabilities of the material, the high abilities of the artists who adopted it, and lastly the approval by the pope of its use, brought stucco into immediate popularity, and it was adopted not only for new buildings erected in Italy, but its use speedily spread throughout Europe.

"There has just arrived at the South Kensington Museum," says Mr. G. T. Robinson, writing in 1889, "a model of the central hall of the Villa Mariana in Rome, which was thus decorated by Julio Romano and Giovanni da Udine, and which exemplifies the adaptability of the process, and in which model Cavaliere Mariani

has employed stucco duro for its execution, showing to how high a pitch of finish this material is capable of being carried. Indeed, it was used by goldsmiths for the models for their craft, as being less liable to injury than wax, yet capable of receiving equally delicate treatment, and Benvenuto Cellini modelled the celebrated 'button' with 'that magnificent big diamond' in the middle for the cope of Pope Clement, with all its intricate detail in this material.

"How minute this work of some six inches in diameter was may be inferred from Cellini's own description of it. Above the diamond, in the centre of the piece, was shown God the Father, seated, in the act of giving the benediction; below were three children, who, with their arms upraised, were supporting the jewel. One of them, in the middle, was in full relief, and 'all round I set a crowd of cherubs in divers attitudes. A mantle undulated by the wind, round the figure of the Father, from the folds of which cherubs peeped out; and there were many other ornaments besides, which,' adds he, and for once we may believe him, 'made a very beautiful effect.'" *

At the same time figures larger than life—indeed, colossal figures—were executed in it, and in our own country the Italian artists brought over by our Henry VIII. worked in that style for his vanished palace of Nonsuch. Gradually stucco duro fell into disuse, and coarse pargetry took its place.

* "Vita di Benvenuto Cellini."

Gesso is a compound of the finest gypsum (plaster of Paris) procurable, or in default thereof fine whiting, mixed with glue size. It is, therefore, somewhat similar in composition to the plaster used by picture-frame makers; but instead of being of about the consistency of putty, gesso is mixed to about the thickness of good cream, and is applied with a brush. Working in it may therefore be rather described as relief painting than modelling, being a kind of bold impasto painting without colour. Thus the early Italian artists, working on panel, laid a coat of gesso on certain parts where they desired a distinctive relief before applying their colours in gilding. Indeed it was almost universally adopted by them as a ground for gold, as in the nimbi, or aureoles, around the heads of saints, the jewellery of the figures represented, &c. The visitor to our National Gallery may see many examples of this practice in the works of the early Italian masters there.

This material was also used in ecclesiastical decoration, especially in ornamenting the retables of altars. An example of this practice is extant in Westminster Abbey.

Nor did its applicability stop here, for it was used during the *cinque-cento* period and after to decorate portions of the magnificent armour and war-saddles then in use, and at that period and subsequently to ornament furniture.

It was well adapted for those purposes from its very considerable tenacity. Indeed its adhesive properties are very great, and it will hold firmly

to smooth surfaces like polished marble or even glass.

Gesso has considerable decorative capabilities for delicate work in low relief, and its use has been recently revived by Mr. Walter Crane and others, very good examples of gesso work being shown by them at the exhibition of the Arts and Crafts Society of 1889. The low-relief designs were generally coloured with lacquers or coated with parti-coloured bronzes, which has a most chaste and elegant effect.

The gesso is, as we have said, applied with brushes (hog's hair and camel's hair fitches and pencils), assisted for high relief by the palette-knife. As the composition dries rapidly, the worker must be prompt. The design can be sketched on the panel or other surface, the gesso laid on, and while yet plastic modelled with the brush. Two or more coats may, of course, be applied where desired, and in some of Mr. Walter Crane's work, where he desired high relief in a frieze, he obtained it by dipping a piece of cotton-wool in the gesso, putting it in its place in the design, and, when necessary, modelling it.

As these descriptions of work will probably hardly fall into the ordinary plasterer's way professionally, we do not deem it necessary to pursue the subject further.

I would also refer the reader to the description of Alabastine (which is a species of ready-made gesso) in Chapter XVIII.

CHAPTER XVI.

Sgraffito.

"Sgraffito" is a method of plaster decoration for mural surfaces but little known or practised in this country, although during the past few years some steps have been taken in order to bring it into more general use. As, carefully carried out, it enables us to obtain excellent decorative results for wall ornamentation, I think it well here to describe the process in some detail.

The Italian words "*Graffiato*," "*Sgraffiato*," "*Sgraffito*," mean simply "scratched." Scratched decoration of some kind is, indeed, the most ancient form of graphic expression and surface decoration employed by the human race. Even the primitive savage of the flint-weapon period was not ignorant of, or incapable of executing, simple work of this nature, as is proved by bone implements in the British Museum, and other museums, both here and abroad, which the flint-chipping early savage has ornamented with scratched or incised designs, frequently very tolerable representations of wild animals now long extinct.

This term "sgraffito" (or "scratched") is,

however, at the present time employed especially to signify ornamentation, scratched or incised, either upon plaster or upon porcelain or potters' clay, the process being conducted in each case while the material is still soft or plastic. With this work as applied to pottery decoration I have, of course, nothing to do here; but as applied to plastered walls I desire to say something about it.

It is necessary to premise, at the outset, that this species of decoration is simply and solely a method of linear ornamentation. There are in it no masses or breadths of colour, as in fresco work, or other kinds of painting. For its beauty of effect, sgraffito depends either solely upon lines incised in the yet soft plaster, according to designs, with the resulting contrasts of surfaces; or partly upon such lines and contrasts, and partly upon the effects of an undercoat of colour revealed by the incisions; while the effect may be further increased and modified by varying the colours of the undercoat in accordance to the design.

In the practice of sgraffito, the plasterer, working from a coloured cartoon, spreads layers of variously-tinted plaster on different portions of the wall-surface, and covers these with a white finishing-coat. When this latter is sufficiently set for his purpose, the sgraffitist, with suitable tools, proceeds to cut the *outlines* of the cartoon in the white plaster down to and exposing the coloured strata in layers. The effect is to pro-

duce a design in coloured *intaglio*, or coloured lines sunk below the general surface of the wall.

A very good example of sgraffito is to be seen at the Albert Hall, South Kensington.

The following instructions for executing sgraffito work are taken from the capital essay upon the subject by Mr. Heywood Sumner (himself an able exponent of the art), prefixed to the catalogue of the second exhibition of the Arts and Crafts Society, 1889 :—

"First, then, as to method. Given, the wall intended to be treated; granted, the completion of the scheme of decoration, the cartoons having been executed in several colours, and the outlines firmly pricked, and, further, all things ready for beginning work.

"Hack off any existing plaster from the wall; when bare, rake and sweep out the joints thoroughly; when clean, give the wall as much water as it will drink; lay the coarse coat, leaving the face rough in order to make a good key for the next coat; when sufficiently set, fix your cartoon in its destined position with slate nails; pounce through the pricked outline; remove the cartoon; replace the nails in the register holes; mark in, with chalk, spaces for the different colours, as indicated by the pounced impression on the coarse coat; lay the several colours of the colour coat according to the design as shown by the chalk outlines; take care that in doing so the register nails are not displaced;

roughen the face, in order to make a good key for the final coat. When sufficiently set, follow on with the final surface coat, only laying as much as can be cut and cleaned up in a day. When this is sufficiently steady, fix up the cartoon in its registered position; pounce through the pricked outline; remove the cartoon, and cut the design in the surface coat before it sets: then, if your register is correct, you will cut through to different colours, according to the design, and in the course of a few days the work should set as hard and as homogeneous as stone, and as damp-proof as the nature of things permits.

"The three coats above referred to may be gauged as follows:—

"*Coarse Coat.*—2 or 3 of sharp clean sand to 1 of Portland, to be laid about $\frac{3}{4}$ inch in thickness. This coat is to promote an even suction, and to keep back damp.

"*Colour Coat.*—1 of colour to $1\frac{1}{2}$ of old Portland, to be laid about $\frac{1}{8}$ inch in thickness. Specially prepared distemper colours should be used, and amongst such may be mentioned golden ochre, Turkey red, Indian red, manganese black, and lime blue.

"*Final Surface Coat.*—Aberthaw lime and selenitic cement, both sifted through a fine sieve. The proportion of the gauge depends upon the heat of the lime—or, Parian cement, sifted as above. This may be useful in a dimly-lighted building, as it dries out very white, but it sets too quick for convenience—or, 3 of selenitic

cement to 2 of silver sand, both sifted as above. This may be used for out-door work.

"Individual taste and experience must decide as to the thickness of the final coat, but if laid between $\frac{1}{8}$ inch and $\frac{1}{12}$ inch and the lines cut with slanting edges, a side light gives emphasis to the finished result, making the outlines tell alternately as they take the light or cast a shadow.

"Plasterers' small tools of various kinds, and knife-blades fixed in tool handles, will be found suited to the simple craft of cutting and clearing off the final surface coat: but as to this a craftsman finds his own tools by experience, and, indeed, by the same acquired perception must be interpreted all the foregoing directions, and specially that ambiguous word, dear to the writers of recipes—*sufficient.*"

A small tool, shaped like that used to cut addresses on packing-case lids, or the wood-carver's V or "parting tool," would, I think, be well suited to most operators, as this can be had of such size as to enable the worker to readily judge when he is cutting deep enough, while yet leaving the colour coat undisturbed and intact.

Mr. Heywood Sumner thus proceeds: "Thus far, methods. Now, as to the special aptitudes and limitations. Sgraffito work may claim a special aptitude for design whose centre of aim is line. It has no beauty of material like glass, no mystery of surface like mosaic, no pre-eminence of subtly-woven tone and colour like tapestry;

yet it gives freer play to line than any of these mentioned fields of design, and a design for sgraffito can be executed in fac-simile undeviated by warp and woof, and unchecked by angular tesseræ or lead lines. True, hardness of design may easily result from this aptitude, indeed, is to a certain extent inherent to the method under examination; but in overcoming this danger and in making the most of the aptitude is the artist discovered. Sgraffito, from its very nature 'asserts the wall,' that is, preserves the solid appearance of the building which it is intended to decorate. The decoration is in the wall rather than on the wall. It seems to be organic. The inner surface of the actual wall changes colour in puzzling but orderly sequence, as the upper surface passes into expressive lines and spaces, delivers its simple message, and then relapses into silence; but, whether incised with intricate design or left in plain relieving spaces, the wall receives no further treatment, the marks of the float, trowel, and scraper remain, and combine to make a natural surface.

"Sgraffito compels a quick, sure manner of work; and this quickness of execution, due to the setting nature of the final coat and to the consequent necessity of working against time, gives an appearance of strenuous ease to the firm incisions and spaces by which the design is expressed, and a living energy of line to the whole."

CHAPTER XVII.

Whitewash, Distemper, Kalsomine, &c.

Whitewashing and the application of coloured washes to walls, technically known as "distempering," fall usually within the province of the plasterer, although often done by painters and decorators. In America superior whitewash is at present generally known by the somewhat affected title of "kalsomine." Ordinary whitewash may be made with whiting or lime.

Ordinary Whitewash.—Break up about 7 lbs. of the best whiting into small pieces in a clean zinc pail with just enough clean water to cover it, and allow it to stand for half an hour. To this a "binder" must be added. Some use size—best London size is to be preferred, with a little bit of blue-black and a small portion of turpentine. But starch is to be preferred to glue, as it does not impair the colour of the whiting. Make, therefore, about a pint of starch ("Glenfield" is the best), dissolve a little soft soap in half a cupful of warm water and add it to the starch and stir well. Then add the starch to the whitewash, stirring the mixture meanwhile. Add

water to bring it to the consistence of cream, and add enough blue to relieve the dead white of the whiting. Strain the mixture through a fine sieve and let it stand for some hours before using. The ceiling should be well washed if smoked or dirty and be permitted to dry. Apply with a good flat double-tie, one in use is better than a new one. If possible go over the whole breadth of the ceiling at once, and avoid visible joins.

Limewash.—Take well-slaked lime; dissolve 2½ lbs. of rock alum in boiling water and add to every pail of the limewash. This compound should be used very thin. As it begins to dry the alum will act as size and bind it to the wall, and the second coat will form a white smooth finish.

Stucco Whitewash.—Put half a bushel of unslaked chalk lime into a cask and slake it with boiling water, and cover it over. Strain when cold through a fine hair sieve. Then dissolve 1 lb. of table salt in warm water and add to the lime solution. Then take 3 lbs. ground rice, 1 lb. glue, and ½ lb. Spanish brown; dissolve these in boiling water, put to former solution, add 5 gallons boiling water, stirring well, and let the mixture stand (with the cask covered) until cold. Make this wash quite hot before you apply it.* This is for external work.

* Adapted from "The Practical Technical Instructor." By Wm. McQuhae, of Cockermouth.

An excellent Whitewash.—The following method of preparing whitewash has been strongly recommended. Take a clean, water-tight barrel, or other suitable vessel, and put into it ½ bushel of chalk lime, slake it by pouring boiling water over it in sufficient quantity to cover the lime five inches deep, and stir briskly until thoroughly slaked. When the slaking has been effected add 2 lbs. sulphate of zinc dissolved in water, and 1 lb. of common salt. This will cause the wash to harden and prevent unseemly cracking on the wall. The addition of 3 lbs. yellow ochre will render this wash cream-coloured; while lamp or ivory black will give a good pearl grey; and a fawn colour may be obtained by the addition of 4 lbs. umber, 1 lb. Indian red, and 1 lb. lamp black. Can be applied with ordinary brush.*

Distemper.—Distemper is simply tinted or coloured whitewash, at one time in very general use, frequently in combination with stencilling, for bedrooms, &c. For distempering old walls or ceilings the surfaces should be well washed with clean water, and if necessary scraped with a trowel so as to remove all the old whitewash or colouring. Then, if there are any holes or cracks they should be carefully filled with a stopping made of fine sifted lime and plaster of Paris. This, when dry, should be rubbed down with glass or sand-paper, wrapped on a bit of flat cork

* From "The Decorator's Assistant." London: Crosby Lockwood & Son.

or board, and well dusted off. The walls should then be sized.

The size may be prepared by the workman himself by boiling ½ lb. of glue in one quart of water until it be perfectly dissolved, or it can be bought (jellied) of an oilman. Cannon's concentrated size is very useful. To this add hot water, and stir until dissolved. One pound packet will make about two gallons—a little less or more according to the strength desired. One coat of size can be applied, warm, to the wall, with a stock brush. If the wall has much "suck" on and absorbs the size entirely, a second coat should be given.

Meanwhile the distemper can be prepared. The foundation of this is whitewash. Sufficient good whiting should be broken up, placed in a clean pail or other suitable vessel, sufficient water being poured in to cover the whiting. It is then left to soak well, and then pour off any superfluous water. If the distemper is to be white, it is best to grind a little indigo, blue black, or ivory black in water and mix with it in order to prevent a yellow cast. The size is then added, warm, and well mixed, and the mixture may then be strained in order to insure thorough mixing and to remove any impurities or lumpiness. It is best to let the compound stand all night, and in the morning it will be a very weak, trembling jelly, which should be used cold, and applied with a good brush, one a little worn preferably. It should be carefully applied

so as to prevent any joins appearing or blotchiness. The proportions may be two of mixed whiting, or whiting and pigment, to one of size. It is better not to decrease this proportion of size, as if there be too much body of colour the distemper is apt to crack and scale off.

Washable Whitewash.—A German paper claims that the following composition applied to walls is so waterproof that it will stand washing. Herr Reschenchek, of Munich, mixes together the powder from 3 parts siliceous rock (quartz), 3 parts broken marble or sandstone, 2 parts burnt porcelain clay, with 2 parts freshly slaked lime, still warm. In this way a wash is made which forms a silicate if often wetted, and becomes after a time almost like stone. The four constituents mixed together furnish the ground colour to which any pigment that can be safely used with lime can be added for producing tints. This preparation is applied quite thickly to the wall or other surface, permitted to dry for one day, and the next day frequently covered with water, which makes it waterproof. This wash, it is stated, can be cleansed with water without losing any of its colour; on the contrary, each time it gets harder, so that it can even be brushed, whilst its porosity causes it to look soft. The wash, or kalsomine, can be used for ordinary purposes, as well as for the final painting.*

* "The Decorator's Assistant." London: Crosby Lockwood & Son.

Fireproof Whitewash.—It has been found that the following fireproof whitewash is a most effective composition for fire-proofing exterior surfaces to at least some degree. Slake a sufficient quantity of freshly burned quicklime of good quality, and when the slaking is completed, add such an amount of skim-milk (or in its absence, water) as will bring the mixture to about the consistency of cream. To every 10 gallons of the liquid are added, separately and in powder, stirring constantly, the following ingredients in the order named:—2 lbs. alum, 24 ozs. sub-carbonate of potassium or commercial potash, and 1 lb. common salt.

If a white appearance is desired, no further addition is made to the liquid, though the whiteness is found to be improved by a few ounces of plaster of Paris. Lampblack has the effect of giving a number of shades, from slate-colour to black. Whatever tint is used, it is incorporated at this stage, and the whole, after being strained through a sieve, is run through a paint-mill. When ready to apply, the paint is heated nearly to the boiling point of water, and applied in this hot condition. It is found that the addition of a quantity of fine white sand to its composition renders it a valuable covering for roofs and crumbling brick walls, which it serves to protect.

CHAPTER XVIII.

Distempering (*continued*).

Although in the preceding chapter I have given a recipe for distemper, I consider the subject of sufficient importance to the plasterer to devote here a chapter to it.

I am partly moved to this by the consideration that if there is what may be called an "artistic side" to any craft, it is surely well that, in the present day especially, the workman should cultivate it and be an adept in its practice. Not, indeed, that I would claim that it requires much artistic faculty to colour a wall properly. Still there is a little more in it of a decorative character —of what we may fairly call the æsthetic element —than there is in "rendering" a brick wall or plastering a plain ceiling. It is my views on this point which have led me in this treatise to devote so much space to modelling, "sgrafito," and decorated ceilings.

The term "distempering" (of dubious etymology) is technically applied to the coating of a surface with coloured washes, rendered firm or adhesive by the addition thereto of a proportion of size, made either from glue or parchment. The effect of such method of decoration is pure, cool,

and refreshing, and hence it has some advantages over other more durable forms of colouring. Decorators have discovered long since, by practical experience, that pigments mixed with oil, however durable and useful for certain purposes, were too heavy in their effect for particular purposes and positions. Hence ceilings, for example, especially those of drawing-rooms, boudoirs, and other delicately-upholstered and furnished apartments in which lightness and elegance are requisite, are usually distempered, and not painted in oil.

And besides the lightness of distemper it is also characterized by much greater purity of colour, and this is an important point in decorating a room where elegance is called for. The naturally yellow hue of linseed oil infallibly imparts a tinge to the more delicate pigments to a far greater extent than weak size (especially vellum parchment size) will do, and thus greater purity of tint is secured.

On the other hand, distemper is not suited for interior walls with which persons may come much into contact, or where rough usage is anticipated, and such (at any rate, so far as a high dado is concerned) are best painted in "flatted" oil colours.

It has been well observed by a judicious writer, in the pages of a well-known technical journal, that careful consideration of, and preparation of, surfaces to be distempered is all important in securing a good result.

A plaster wall almost invariably manifests what is known as "suction," that is to say, a tendency to absorb—and frequently absorb unequally—moisture or liquid. A little consideration of the nature of plaster and of the varieties of surface upon which it is spread will convince any one that this is inevitable. Where this tendency exists unchecked it acts very detrimentally upon distemper, preventing the finishing coat from laying on cool, making the work look rough and uneven, and causing the colour to gather in places, so as to produce a shady, spotty, or smeary appearance. Almost invariably one part of a surface—say, a ceiling or wall—will be found to have a greater readiness for absorbing colour than another part, arising either from differences in the stratum upon which the plaster was spread, or the unequal finish of the plaster work itself.

In order to neutralise this suction a preparatory coat should be laid on before the coloured coat itself. (See "Distemper" in Chapter XVII.)

I quote here the following advice contributed to the trade journal, to which I have just alluded, by a careful technical writer, who signs himself "An Experienced Workman":—

"In order to produce good work two things are essentially necessary in the mixing of distemper—namely, clean and well-washed whiting and pure jellied size. The whiting should be put to soak with sufficient soft water to cover it well and penetrate its bulk. When the whiting is sufficiently soaked, the water should be poured

off, which will remove any dust or foreign matter from the whiting. It should then be beaten up or stirred until all the lumps are broken, and it becomes a stiff, smooth paste. A good workman will do this carefully with the hand, and will manipulate it until it becomes quite smooth, but it may be done most effectually with a broad stick or spatula, and then strained through a metal or other strainer. The size should now be added, and the two lightly but effectually mixed together. Care should be taken not to break the jelly of the size more than can be avoided, and this may best be done by gently stirring the mixture with the hand. If the jellied state is retained intact, the colour will work cool, and lay on smooth and level. The size, whether made of parchment clippings, glue, or any other material, should be dissolved in sufficient water to form a weak jelly when cold. In practice we find that distemper mixed with jellied size will lay on better and make a better job than when size is used hot. Colour mixed on the former plan works cool and floats nicely, while the latter works dry, and drags and gathers, thus making a rough ceiling or wall, and the labour required is very much in favour of the jellied size. A little alum added to the distemper has a good effect in hardening, and helps it to dry out solid and even."

Many, however, prefer to make their own size from vellum or parchment clippings, as procuring thereby a strong size, even more colourless than the best jellied size obtainable of the shops. These

clippings are the rounding off of the skins and can be obtained of parchment dealers, vellum-binders, &c. These clippings should be cut into smaller pieces and placed in an iron pot, which is then filled with water. This should be permitted to stand for twenty-four hours, until the parchment or vellum is thoroughly soaked, when the pot is to be placed on a fire and the contents boiled for five hours, skimming off the scum which arises occasionally. When the liquid is sufficiently boiled, it should be strained through a coarse cloth. If size be kept for any considerable length of time it loses strength. When this is the case, dissolve 3 ozs. or 4 ozs. of alum in some boiling water, and add to each pailful of size. It should then be boiled again until it becomes very strong, strained again, and put aside in a cool place, when it will keep for several weeks.

With regard to tinting the whiting, the following will be found a useful list of colours:—

Pearl Grey.—The admixture of a small proportion of lampblack to the whiting will produce this. Take care to mix intimately and well. Darker shades may be obtained, according to taste, by using a larger proportion of the black.

French Grey.—Soak a sufficient quantity of whiting in water. Add to this a small portion of Prussian blue and crimson lake which have been carefully ground in water, and mix well. The proportion of these tinters to the whiting will depend upon the degree of warmth required in the wash. Mix with size and strain.

Buff.—Dissolve separately whiting and yellow ochre in water, and mix. If greater warmth is required add a little Venetian red. Mix with size and strain.

Orange.—Whiting, French yellow or Dutch pink and orange lead, proportioned to taste. These colours must be worked in a size jelly, as in water alone the orange lead, being very heavy, will sink.

Pink.—Dissolve whiting and rose pink separately in water and mix to the shade required. Strain and add size.

Blue.—Grind some indigo carefully in water, add to whiting. Then add size and strain.

Lilac or *Mauve.*—Add indigo as in last recipe until whiting is of a dark grey, then add some rose pink, ground in water. Well mix, strain, and add size.

Salmon Colour or *Terra-Cotta.*—Tint the whitewash with Venetian red well ground.

Drab.—The whiting solution may be tinted either with burnt umber, yellow ochre, and a little lampblack mixed, or Venetian red, each finely ground in water.

If the ceiling is at all dirty, it should be well washed before distempering, and if the plaster is really stained by damp or any other cause so that washing is not effectual, one or two coats of oil colour had better be laid on by the painter before the distemperer commences operations.

In distempering it is best to close the doors and windows of the room while the work is being

carried on. But when the job is finished they should be thrown open, as the more quickly distemper dries the better.

Calcarium.—Under this designation two very useful specialities for coating plastered walls are manufactured by Messrs. A. T. Morse and Co., of Bristol, London, and Manchester, known respectively as the "Improved Patent Calcarium," and the "Improved Patent Calcarium Distemper."

Morse's improved patent calcarium is a fast *washable* distemper, non-poisonous, made in a variety of pretty and effective tints, for which it is claimed that it is admitted by experienced workmen and others to be the best water colour manufactured for mansions, dwelling-houses, churches, chapels, colleges, schools, clubs, unions, hospitals, asylums, and for public and private buildings generally, at home or abroad. It is the cheapest material manufactured for general wall and ceiling decoration; is one-fourth the cost of lead paint, easy of manipulation, of greater durability than whiting and size or limewash, and possesses the advantage over those in that cleaning off when re-doing is not necessary, as under the old system. Moreover, it is the most durable water-colour for old or new work, damp-resisting, hard-drying, and suitable for both inside and outside walls. Its covering power is excellent, as for inside work 1 cwt. will cover 200 to 300 square yards; outside work, 100 to 200 square yards.

The second speciality to which I would advert

is Morse and Co.'s ready prepared patent distemper, a preparation for covering the walls, ceilings, &c., of public and private buildings of every description, kept in forty-eight shades, which is a very cheap and easily applied wall-coating, not dearer than ordinary distemper, and superior in appearance and purity of tone to the best flatted paints. This preparation may be used on all kinds of surfaces. The distemper is mixed in the proportion of 7 lbs. of the powder to 1 gallon of hot or cold water (hot is preferable and quickest). There is no need that the work should be sized, but if it be so it will be no disadvantage. One, two, or three coats may be laid on, but one is generally sufficient. 1 cwt. covers an average of 1,200 square yards one coat; 3½ lbs. will twice coat an average-sized ceiling, and 7 lbs. an ordinary room.

Alabastine.—Another novel speciality which deserves mention is Church's "Alabastine," manufactured by Messrs. John Line and Sons, of Reading and London. Although the manufacturers call this preparation "Patent Anti-Distemper," alabastine may be considered as essentially a distemper, seeing that it is mixed with water, not oil or varnish. Alabastine is prepared in the form of an impalpable dry powder, and is sold in packets, in white, and in twenty-three beautiful colours, which, from the colours being chemically united, form solid tints of great beauty, which are very durable, and do not fade. This

powder is mixed with cold water only, thus dispensing with the addition of the animal matter of size, and avoiding that glue coat which is the natural culture-ground of those pests of modern civilisation — disease-germs or bacilli. It is claimed for alabastine that it is as cheap as ordinary distemper, and is superior to any other composition in being at once sanitary, economical, and artistic. One pound of alabastine will cover ten square yards of average wall, giving two coats.

The notable characteristic of this preparation, however, is that it is not only designed for coating walls, in place of distempers, but for heavy relief work, somewhat analogous to decorative plastering. By mixing the powder with water to the required consistence, designs and effects in *bas-relief* may be produced on wall surfaces to an extent only limited by the skill of the workman. Beautiful effects can be obtained in stalactites or heavy stippling, modelling, gesso-work, scrolls, and figures in tints, tiling, glossing or flashing, white crystal relief, old ivory relief, bronzing or metallizing, &c.

For stippling or heavy combing, stir about 2 measures of alabastine in 1 of water until perfectly smooth.

For modelling flowers, majolica, &c., mix in the proportion of $2\frac{1}{2}$ of the powder to 1 of water, and let it stand from one to two hours; it may then be used for two or three hours for modelling, &c., with the hand.

For gesso-work, mix according to the style of work and degree of relief required. It is best for low relief and brush work, and for this should be mixed to the consistency of thickish cream. Draw the design first on a ground painted with alabastine, either on wood or plaster, and then model with a fine brush. The work can always be added to or finished when set; but if a smooth surface is required, it is best to complete before the alabastine sets. Wash the brush in hot water, to prevent clogging.

As to the tools used in relief work, for combing, use the ordinary steel graining comb, taking out every alternate tooth for coarse combing. Incline the comb forward as it is drawn, to prevent cutting clear through to the wall. To enable one man to comb a large space alone, apply the alabastine heavy, a little ahead of the combing—but not enough to let it dry—and pass a brush over it with cold water. For stippling an ordinary stippling-brush may be used; but best fine stippling is done with a block, covered with a piece of plush carpet, say 3 by 6 to 4 by 8 in size.

Alabastine, it may be noted, is not only designed for coating walls in place of distemper, and for solid relief work, but it is a superior finish for new walls, and a substitute for what is known in the trade as "hard finish," or the white putty top coat of plaster. It makes a most durable and handsome wall in any delicate tints required. It is more convenient as well as cheaper, and should be done after the other work is finished and the

building dried out, thus filling and hiding the cracks always found in new walls, caused by the shrinking of the timbers after being swollen by the wet plaster. The work can be nicely done in tints on brown plaster with one coat, if the plaster is dry, and care is taken to touch every spot. One kind of plastering used, and much admired for this purpose, is made with what is called a fine browning, floated or trowelled off level. If a smooth wall is desired, it should be made with a smooth sand finish. On the first coat of mortar alabastine makes a good finish. It works well on a very rough wall, as sometimes made in churches; but a smoother is cheaper and better finished. The new plaster should always be thoroughly dry before applying alabastine.

Duresco.—Ordinary distemper, being an aqueous preparation, possesses no property of resisting humidity, and is, therefore, affected either by dampness of a wall or by the application of water, as in the case of rain. Consequently its use for external walls is almost *nil.*

For such purposes, however, an efficient substitute for ordinary distemper may be found in "Duresco," a washable water-paint, manufactured by J. B. Orr & Co., Limited, of London and Charlton.

"Duresco," its manufacturers assert, "possesses enormous covering power or body; is much more durable than oil paint, even on the most exposed situations; is excellent for interior

decoration, either for plain distempering or artistic treatment; dries with a perfect flat, uniform surface, entirely absorbent, cheaper than wall paper or oil paint; destroys fever germs, and prevents vermin." A great point to be noted in duresco is that it can be applied to actually damp plaster; or, in other words, it can be put on plaster two days old.

Another meritorious preparation of the same firm is their "Petrifying Liquid," or Solution of Silica, used alone or in conjunction with duresco. It is claimed that several coats of this material will entirely stop the penetration of rain through porous surfaces, so that for hardening soft stone, bricks, &c., the liquid is unsurpassed. Unlike other "anti-damp" preparations, which usually have oil or spirit for a vehicle, it is a *water paint*, and consequently, by affinity, penetrates deeply into the pores of the damp surface to which it is applied, and with which it may be also said to combine. On becoming dry and hard it is never again soluble in water; being practically colourless, it does not appreciably alter the character of the surface to which it is applied. Unlike glue-size, it cannot decompose. It can be applied (it is stated) upon plaster only three days old, and the application of two or three coats renders an otherwise porous new plaster surface entirely non-absorbent and ready to receive distemper or oil paint.

The following are the directions given for using duresco and the petrifying liquid:—

As a washable water paint on new or old decorated surfaces.—Thin out the body Duresco (of the shade chosen for finish) with Petrifying Liquid. This should give a slightly glossy ground; but if still sunk in, touch up same, so that all may be bearing out, as in oil paint. No water to be used in the under coats. For succeeding coats mix up body Duresco with cold water only, and apply fairly thick, using a stippler for a good flatted finish.

As a washable water paint on old distempered walls.—Wash off all old distemper, then "stop" with plaster and Duresco, and apply Petrifying Liquid and body Duresco as described above. Old painted plaster walls can be treated in the same way. Use two-knot or one-third worn whitewash brushes. Sponge off spots as the Duresco hardens quickly. Decorate in turpentine colour, no oily edge will appear. Should a surface finished in Duresco be afterwards painted, one coat oil paint will bear out on it. Duresco can be used on compo or brickwork before oil painting to stop suction, thereby saving many coats of oil paint.

As an anti-damp.—Thoroughly remove all size colour, &c., and give plaster two coats Liquid Duresco mixed with one-fourth body colour. After standing twenty-four hours walls can be hung with paper, or finished with body colour as above directed or finished in oil paint.

As a cure for smoke or water-stains.—One coat liquid and body colour mixed equal parts will effectually prevent smoke or water-stains from

showing through ceilings when size-tinted over it.

As a preparation for ceilings, &c. — Liquid Duresco mixed with a fourth body can be used to advantage (one coat) either on bare plaster or lining-paper (instead of oil paint) before size colouring.

As an obscuring colour for glass.—Liquid and body colour Duresco equal parts, reduced with water and tinted to required shade, will be found useful for obscuring glass. Once hard, it will remain good for years.

As a preservative for stone, brick, cement, &c.—Give the work two coats Liquid Duresco, and if much discoloured, add one-eighth body colour mixed to shade required. Reduce last coat to the extent of half with water to avoid gloss. Stonework much decayed should be thoroughly brushed out before applying it. Bricks coated their natural colour with Duresco makes a much better finish than with oil paint.

Silicate Paint.—Of course, besides "distemper" proper, which consists essentially of a solution of whiting in water, stained to the requisite tint by some mineral pigment, and containing a certain proportion of size as a binder, oleaginous coatings, consisting of various pigments in an oily vehicle—to which we generally apply the term "paint"—are frequently applied to surfaces of plaster and stucco.

I do not, of course, touch upon that subject, because to do so would be to leave my own proper province and poach on the domain of the house-painter, a line of conduct to be avoided by every true workman; but I may be permitted here to point out the great usefulness of a comparatively novel covering preparation. This is the "Silicate Paint" manufactured by the Silicate Paint Company, of London and Charlton.

In this preparation the objectionable and poisonous white-lead which forms the base of most paints is abandoned, and replaced by the Company's own zinc-white, the "Charlton white," the great merits of which are admitted by all sanitary authorities. The objections to the ordinary lead pigments used by the house-painters are not only that they are poisonous, of offensive odour, and suffer decomposition and discolouration in the presence of foul air, but that when used to protect out-door work from extreme atmospheric influences, they do not effectually answer this purpose, for they either speedily crack, blister, or peel away, or, becoming disintegrated, are washed from the surface they were intended to preserve.

The silicate paint is manufactured in a number of shades, the colours (it is stated) being quite permanent.

Another speciality of the Company, the "Charlton Enamel Paint," gives a hard, richly glossy enamel surface, of extreme durability.

The paint is made in a variety of beautiful colours, which it retains under all conditions. In addition, it is a waterproofing preparation of the very best description, and will thoroughly resist the penetration of moisture, however copious, by any surface of brick, wood, or plaster to which it is applied.

APPENDIX.

PLASTER *versus* MATCH-BOARDING.

A VERY absurd practice has of late years become common in this country of lining the interior walls of shops, offices, &c., with what is known as "match-boarding," or thin pine boards, grooved and tongued together and placed vertically, these being afterwards stained and varnished; and for many kinds of work this ridiculous fashion has well-nigh superseded the old-fashioned plastering. It is a very pregnant comment on the good sense of the builders of a nation popularly supposed to be one of the most common-sense peoples of the world, that, concurrently with the adoption of all kinds of devices to render edifices fireproof, we should adopt a style of internal fitting than which none can possibly be more inflammable.

Nor has wood lining any good qualities to counterbalance its disadvantages. The great and wise king of Israel, Solomon, as we know from Holy Writ, lined the walls of the magnificent temple which he raised on Mount Moriah with boards of

the close-grained and odoriferous cedar of Lebanon, and mansions of ancient date in our own land were frequently wainscoted or lined with oak. But both cedar and oak were woods of good appearance, exceedingly durable, and not over combustible, whereas the trashy wall-linings of knotty and resinous pine have a poor look, encourage vermin and insects, are easily defaced and damaged, and are highly inflammable. It is to be hoped that the popularity of match-boarding is only a temporary folly and will pass away.

Even for internal partitions we can now, by the aid of wire-netting foundations and the use of some of the modern fireproof cements, produce plastered surfaces, which, if they will not absolutely bid defiance to fire, are certainly competent to do much to resist or retard conflagrations. Such are the "Fireproof Cement" manufactured by Messrs. Joseph Robinson & Co., of Carlisle; and the "Adamant," a patent plaster manufactured by the Adamant Plaster Company, of Birmingham (both of which have been described under the head of "Materials"). The improved "Fibrous Slabs," of Messrs. Samuel Wright and Company, of Amhurst Road, Hackney, London, are also characterized by a high degree of incombustibility, these slabs consisting of fibrous plaster on a stratum of fine wire netting. It is claimed for these by their manufacturers that they are highly fire-resisting, render falling ceilings an impossibility, and, moreover, possess other merits.

The fact that these slabs have been extensively

used in the London Board Schools is certainly high testimony to their merits, although it can hardly be expected that I, in a book on plastering, written to improve technically the plasterer's art, should look with much favour on a speciality which goes to deprive the operative plasterer of his occupation. Any reader, however, desirous of learning more about the fibrous slabs, should apply to Messrs. Wright & Co.

That I am not singular in my dislike to the extremely dangerous match-boarding is clearly demonstrated by the expressed opinions of two competent experts, given after a fatal fire at Clapham some time back, in which two persons lost their lives, and others were severely injured. Anent this case, the following opinions were publicly given :—

Professor Roger Smith, District Surveyor of Wandsworth, said, in answer to questions addressed to him at the inquest, that he greatly deprecated the present system of lining shops with match-boarding, and characterized it as extremely dangerous in case of outbreak of fire; he also recommended that staircases in places of business, where a large number of persons are employed, should be enclosed in fire-resisting partitions.

Mr. Robert Walker, District Surveyor for St. Martin's-in-the-Fields, gave corroborative evidence, and said he regarded the place as a death-trap owing to its being match-boarded. He further advocated that such inflammable houses

should be covered with fibrous plaster, which was the best non-conductor of fire he knew of.

These opinions were expressed in the verdicts of the jury, who suggested that the Legislature should intervene to prevent the use of match-boarding in buildings where inflammable goods are sold, and severely censured those responsible for the state of things disclosed by the inquiry. The insurance companies, it may be remarked, are equally agreed as to the dangerous character of match-boarding.

RECIPES.

Blue Distemper.—Add indigo, previously well ground in water, to the whitewash.

Buff Distemper.—Add yellow ochre to the whitewash. If a warmer tone be desired, add a small portion of Venetian red, well ground.

Compo (*or Elastic*) *Moulds.*—Take 1 part good Scotch glue, 2 parts green treacle, break the glue up into small pieces, place these in a pipkin, pour over them sufficient water to cover them, and let the glue soak for 24 hours, then place the contents of the pipkin in the inner vessel of an ordinary glue-pot, and melt over the fire in the ordinary manner. When melted, add the treacle, stirring well.

Drab Distemper.—Add burnt umber, yellow ochre, and a little lampblack, mixed, to the whitewash, or a little Venetian red. The pigment must be well ground in water.

Fine Stuff (*or "Putty"*).—Take the best lime procurable, dissolve in water, and pass through a hair-sieve.

French Grey Distemper.—Add a little crimson lake and Prussian blue, carefully ground in water, to the whitewash.

Gauged Stuff.—Take 3 parts fine lime, 1 part plaster of Paris, gauge lime with water, and add plaster. Or 4 parts lime and 1 plaster of Paris.

Lilac Distemper.—Add indigo, previously well ground in water, to the whitewash, then add rose-pink, similarly ground, then strain, and add size.

Limewash for Ceilings and Walls.—Take well-slaked lime and reduce to a workable solution with water, dissolve 2½ lbs. rock alum in boiling water, add cold to each pail of limewash. Use very thin.

Modelling Wax.—Take 200 clear wax, 26 Venice turpentine, 13 lard, 145 precipitated bole Armenian, mix and knead well in water.

Moulding Wax.—Take ½ lb. bee's-wax, ½ lb. black resin, and 6 ozs. tallow, melt, and mix together.

Orange Distemper.—French yellow or Dutch pink and orange lead added to the whitewash until desired tint is obtained. The solution must be made with a weak size jelly, as water only is too weak to hold up the heavy orange lead.

Parchment or Vellum Size.—Take clippings of vellum or parchment, cut up small, place in an iron pan, fill same with water, and boil for five or six hours, removing any scum which may arise, then strain carefully.

Pearl Grey Distemper.—Add a little lampblack to the whitewash.

Pink Distemper.—Rose-pink added to the whitewash.

Plaster Casts, to Toughen.—Place the cast in a hot solution of glue for a sufficient time to allow cast to be well saturated. This will toughen the plaster so that a nail may be driven in without causing it to split.

Rough Stuff.—Take 16 parts sharp sand, 4 of good lime putty, and 1 of bullock's hair; riddle sand through a ¼-inch mesh sieve, beat hair well with a flat lath until fibres are well separated, or let it soak in water for forty-eight hours; add sand to putty and mix intimately, then add hair, and thoroughly incorporate. Let it stand for a time before using. This is suitable for first coat.

Salmon-coloured Distemper.—Add Venetian red to the whitewash.

Second Coating (*for lath-work*).—Take 4 lime-putty, 8 sharp sand, and ½ hair, add the sand to the putty, throw in the hair, and mix it well with the other ingredients with the larry.

Size.—Melt good glue in the usual way, and pour out the contents of the glue-pot into a vessel filled with boiling water, stirring well until the solution is of one consistence.

Squeezing Wax.—Same as for "Modelling Wax."

Stucco (common).—Take 1 part hydraulic lime, 3 or 4 parts clean sharp sand, gauge. (For other kinds, see Chapter V., "Mixtures.")

Stucco Duro.—Take 2 parts good lime, 1½ parts fine sand, and 1 part pounded white marble, gauge, mix well, and beat up with a lath or piece of stick until well amalgamated and plastic.

Stucco Whitewash.—Take ½ bushel white unslaked lime, put it in a cask and slake it with boiling water, cover it over, when cool strain through a fine sieve; dissolve 1 peck of salt in warm water, and add to it; take 3 lbs. of ground rice, 1 lb. glue, and ½ lb. Spanish brown (powdered); dissolve these in boiling water, then add to the former mixture and 5 gals. of boiling water, stir it well and let it stand covered up for a few days. Apply quite hot.

Whitewash (or White Distemper).—Break up 7 lbs. best whiting in a metal pail and pour in just sufficient clean water to cover it, and allow it to stand for half an hour, add a portion of size or solution of starch as a "binder," and a little blue; stir well, and add water to bring the whitewash to consistency of cream. (See Chapter XVII., "Whitewash," &c.)

GLOSSARY.

Adamant Plaster.—See Chapter IV.

Aggregate.—The sand, gravel, &c., mixed with Portland cement for making concretes.

Alabaster.—See Gypsum.

Alabastine.—A gesso distemper. (See Chapter XVIII.)

Arris.—A sharp external angle or corner.

Atkinson's Cement.—See Chapter IV.

Bastard Stucco.—Hair enters into the composition of this species of plaster. (See Chapter V.)

Blowing.—The fermenting action of quicklime during slaking.

Blue Lias Lime.—Lime made from rock of the lias formation instead of from limestone.

Calcarium.—A modern distemper speciality. (See Chapter XVIII.)

Cartoon.—An ornamental design or drawing on cartridge paper.

Cement.—A general name for various artificial compounds into whose composition lime enters, and which are capable of being used for either cementing or plastering purposes. (See "Portland Cement," "Roman Cement," &c., in Chapter III. and IV., "Materials.")

Centre Flower.—A plaster ornament to fix on the centre of a ceiling.

Coarse Stuff.—A rough composition of lime and sand. (See Chapter V.)

Coffer.—A rectangular depression in an ornamental ceiling.

Common Stucco.—Is composed of sand and hydraulic lime. (See Chapter V.)

Concrete.—A mixture of Portland cement and gravel or other aggregate.

Cornice.—An assemblage of projecting mouldings placed at the junction of a wall and ceiling.

Cove.—The soffit or top of a semicircular or semi-elliptical recess.

Cradle.—A wooden frame to lath and plaster on.

Derby.—See "Float."

Distemper.—Whitewash stained to colours by the addition of a pigment.

Drag.—A large three-toothed rake or hoe, also termed a "larry." (See Chapter II., "Tools.")

Duresco.—A waterproof distemper. (See Chapter XVIII.)

Edge-runner.—The travelling wheel of a mortar or plaster mill.

Encaustic.—A method of painting walls, &c., in colours mixed with wax.

Expanded Metal.—Thin steel forming a net foundation for plastering. (See Chapter VII.)

Feeding Spade.—See "Server."

Fibrous Plaster.—Plaster combined with wire in slabs according to the patent of Messrs. Wright & Co. (See Appendix.)

Fine Stuff.—A variety of plaster superior to "coarse stuff." (See Chapter V.)

Floating.—Bringing a plaster surface to a true level by the use of the "float."

Float.—A piece of flat straight-edge board, generally about 12 feet long, provided with a couple of handles. The term is also applied to the "derby," or "hand float," which is small, and of the same shape as the "laying-tool," but made of wood. (See Chapter II., "Tools.")

Fire Cracks.—Small cracks in plaster.

Firring up.—"Firring up," or "Furring up," is the obtaining of a level surface by the process described in Chapter VI.

Fresco.—A species of painting or mural decoration applied to plastered walls, generally executed in some species of Encaustic.

Gauge.—The "gauge" denotes the consistency of a given mixture, or what proportion of water has been employed to slake the lime, &c.

Gauging.—The mixing of lime, gravel, sand, &c., with water in the preparation of plaster. (See Chapter V. "Mixtures.")

Gauged Stuff.—Composed of "putty" and plaster. (See Chapter V.)

Gauging Box.—A wooden platform with three low sides, used for making mixtures in. (See Chapter II., "Tools.")

Gauging Pit.—A pit made in the earth near where the work is to be done, 10 or 12 feet square and from 6 to 9 inches deep. The soil removed is banked up around the pit, so as to make its actual depth from 1 foot 6 inches to 2 foot. (See Chapter V., "Mixtures.")

Gesso.—A fine hard plaster or "stucco duro" (which see), very useful for relief modelling. Cotton-wool is often combined with it by modern workers in it. (See Chapter XV., "Gesso.")

Glue.—A well-known gelatinous substance prepared from animal hides and skins.

Graining Comb.—A painter's tool used in thin gesso manipulation.

Gypsum.—See "Plaster of Paris."

Hair.—Ox and cow hair, clean and free from grease, is mixed with plaster to add cohesive power.

Hawk.—A bit of flat board with a short handle below it, to bear the plaster with which the "hawk-boy" attends on the plasterer. (See Chapter II., "Tools.")

Hydraulic Lime.—Lime made from stones of partially argillaceous character, and which possess the useful quality of setting under water.

Jellied Size.—Glue which has been melted, thinned down to a proper consistency for distemper, and left to cool.

Joint.—The mortar between courses of brickwork or single bricks.

Kalsomine.—The American term for whitewash.

Larry.—A large three-pronged rake or hoe used in mixing, also called the "drag." (See Chapter II., "Tools.")

Laths.—Thin strips of wood used to nail on studs or joists, &c., as a foundation to receive plaster.

Laying Tool.—See "plasterer's trowel."

Lime.—A caustic substance artificially prepared by burning fragments of limestone rocks in a kiln, so as to drive off their aqueous constituents. Ordinary limestone is a rock of calcareous (chalky) character, sometimes also containing argillaceous (or clay-like) elements.

Martin's Cement.—See Chapter IV.

Mastic Cement.—See Chapter IV.

Medina Cement.—See Chapter IV.

Metallic Cement.—See Chapter IV.

Mortar Mill.—A circular iron pan, which revolves under a stone or iron "edge-runner," or revolving vertical wheel, used for mixing and triturating mortar, and frequently plaster.

Patera.—An ornament of a circular form.

Petrifying Liquid.—A silicate solution for walls. (See Chapter XVIII.)

Pilaster.—A semi-pillar attached to and projecting from a wall, often executed in stucco.

Pin-point Stucco.—Fine modelled wall plaster in the Alhambra of Granada.

Plafond.—The French equivalent for our word "ceiling."

Plaque.—A square ornament.

Plaster.—This word (anciently spelled "plaister") is considered to be derived from the Greek *εμπλαστρον*, through the Latin *plastrum* and the Norman-French *plaistre*, and was and is applied to various adhesive materials which could be spread on substances, as mud, lime and sand, diachylon, Burgundy pitch, mastic, &c.

Plasterer's Trowel.—The large "laying tool" used in applying and spreading plaster.

Plaster of Paris.—Calcined "gypsum," or sulphate of lime, much used in ornamental plaster work.

Plumb-bob.—A leaden ball at the end of a line.

Portland Cement.—See Chapter IV.

Pouncing.—Rubbing white, black, or other coloured powder through the holes of a pricked design, so as to transfer it to any surface desired.

Putty.—Plasterer's "putty" consists of pure lime dissolved in water and permitted to subside. (See Chapter V.)

Quicklime.—Freshly burned lime, which is in a perfectly anhydrous condition.

Rib.—Projecting members which divide a ceiling into rectangular or other shaped portions.

Riddle.—A circular wire sieve, through which the materials for the various mixtures are passed. (See Chapter II., "Tools.")

Robinson's Cement.—See Chapter IV.

Rococo.—The debased Renaissance style of ornament of the time of Louis XV. and XVI.

Roman Cement.—See Chapter IV.

Rough Cast.—A coarse mortar of lime and washed gravel, used extensively at one time in external work. (See Chapter V.)

Rule.—The common long float.

Sand.—Small particles of siliceous (flinty) rock, used as a necessary constituent of mortar, concrete, coarse plasters, &c. Pit or river sand is suitable; sea sand, on the contrary, being unfit, from its saline character.

Scagliola.—An artificial marble.

Screeds.—Raised fillets formed of plaster along the margin of a certain superficies to be plastered, in order to guide and aid the workman in floating the plaster thereon. They are generally about 4 inches wide, and of the height of the desired thickness the plaster is to have.

Screen.—A large parallelogrammatic shape wire sieve,

set up in an inclined position for screening materials, thereby separating coarse from finer particles. (See Chapter II., "Tools.")

Selenitic Cement.—See Chapter IV., "Materials."

Septaria.—The petrified *excreta* of extinct animals, found in nodules in the Isle of Sheppy, Harwich Harbour, and elsewhere, and used in the manufacture of Roman cement.

Server.—A small spade with which the boy feeds his "hawk." (See Chapter II., "Tools.")

Sgraffito.—An Italian term signifying "scratched" decoration, or incised lines in plaster.

Sieve.—Circular wire "riddles," and also hair sieves are used by the plasterer for separating materials in powder. (See Chapter II., "Tools.")

Silicate Paint.—A petrifying distemper. (See Chapter XVIII.)

Slaking.—The neutralising of the causticity of quicklime by the addition of water thereto. (Frequently spelt "slacking," as pronounced.)

Stippling.—Beating over a plaster or distemper surface with a painter's flat "stippling brush" to modify and equalise it.

Straight-edge.—A long piece of board with its edge shot perfectly true, employed for testing the levelness of surfaces.

String-course.—A horizontal projecting member in a wall.

Stucco Duro (*i.e.* hard or durable plaster).—Fine plaster, invented during the fifteenth century by some celebrated Italian artists. (See Chapter I., "Historical.")

Suction.—The tendency of a plastered wall or ceiling to absorb moisture.

Tripoli.—Known also as "rottenstone," a fine powder, formed of remains of fossil animalculæ, used in polishing.

Trowel.—A flat parallelogrammatic plate of steel, with a semicircular top, and a handle at the back, used for laying on the plaster. Also a kite-shaped steel

plate, with a handle at one end, after the fashion of a bricklayer's trowel, used for clearing and picking out cornices, &c. (See Chapter II., "Tools.")

Trowelled Stucco.—A fine description of plaster worked to a smooth surface with the trowel. (See Chapter V.)

Vaulted.—An arched ceiling.

Water of Ayr Stone.—Known also as "snakestone," and "Tam o' Shanter Stone," a fine hone used for finally smoothing the surface of stucco, scagliola, &c.

Whitewash.—Whiting and water for ceilings and walls. (See Chapter XVII.)

Wire-netting.—Network of fine iron wire, made by machinery, and sometimes used instead of lathing.

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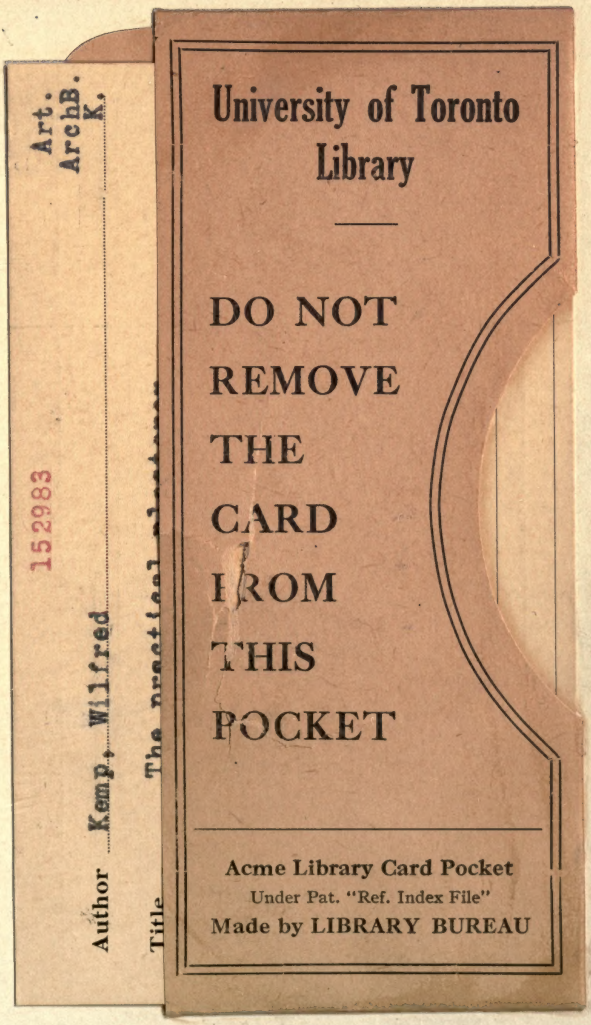
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